

OSHA COMPLIANCE MANUAL**PERSONAL PROTECTIVE EQUIPMENT****INTRODUCTION****1910.132 General Requirements**

(a) Application. Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact.

Under OSHA, you are required to provide a hazard-free environment for your employees. Anyone encountering hazardous conditions must be protected against the potential hazards. The purpose of personal protective clothing and equipment (PPE) is to shield or isolate individuals from the chemical, physical, and biological hazards that may be present in the workplace.

In general, it is just good common sense to have PPE available for whatever emergency situation could arise in your operation. The use of PPE is specifically required by OSHA in 29 CFR 1910, in at least the following places:

- 1910.94(a)(5) - Abrasive Blasting
- 1910.95(b)(1) - Noise Exposure
- 1910.120 - Hazardous Waste Operations and Emergency Response
- 1910.137 - Electrical Protective Equipment
- 1910.156(f) - Fire Brigades
- 1910.252(b)(2) and (3) - Welding, Cutting, and Brazing
- 1910.261(b)(2) - Pulp, Paper, and Paperboard Mills
- 1910.262(qq) - Textiles
- 1910.266(d)(1) - Logging Operations
- 1910.1000(d) - Asbestos Exposure
- 1910.1200(h)(2)(iii) - Hazard Communication Standard

HAZARDS OF PPE

While personal protective equipment is part of the job in some industries—face shields for welding—as a rule, it is considered a last-resort, temporary type of protection. For normal operations, first choice will always be given to eliminating the hazard in the environment rather than using PPE. This is called implementing engineering controls.

No single combination of protective equipment and clothing is capable of protecting against all hazards. Thus, PPE should be used in conjunction with other protective methods. The use of PPE can itself create significant worker hazards, such as heat stress, physical and psychological stress, and impaired vision, mobility, and communication.

In general, the greater the level of PPE protection, the greater are the associated risks. For any given situation, equipment and clothing should be selected that provide an adequate level of protection. Over-protection as well as under-protection can be hazardous and should be avoided.

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Using PPE improperly or in a manner unsuited to its design and purpose is worse than using no protection at all. Without any protection, the worker knows he is vulnerable and perhaps, takes precautions. With some protection, the worker may rashly blunder into severe difficulty, thinking he is safe.

DEVELOP A PPE PROGRAM

Management dedicated to the safety and health of employees should use that evaluation to set a standard operating procedure for personnel, then train those employees to use, maintain, and clean the equipment to protect themselves against those hazards.

A written PPE program should be established for the workplace. The two basic objectives of any PPE program should be to protect the wearer from safety and health hazards, and to prevent injury to the wearer from incorrect use and/or malfunction of the PPE.

To accomplish these goals, a comprehensive PPE program should include:

- Hazard assessment of the workplace,
- Medical monitoring,
- Environmental surveillance,
- Selection, use, maintenance, and decontamination of PPE, and
- Employee training.

Program Review and Evaluation

Your PPE program should be reviewed at least annually. Elements which should be considered in the review include:

- The number of person-hours that workers wear various protective ensembles,
- Accidents and illness experience,
- Levels of exposure,
- Adequacy of equipment selection,
- Adequacy of the operational guidelines,
- Adequacy and effectiveness of training and fitting elements,
- Coordination with overall safety and health program,
- The adequacy of program records,
- Program costs, and
- Recommendation for program improvement and modification.

The results of the program evaluation should be made available to employees and presented to top management so that program adaptations may be implemented.

EXACTLY WHAT IS PPE?

Personal protective equipment includes all clothing and accessories designed to create a barrier against workplace hazards. The basic element of any personal protective equipment management program should be an in-depth evaluation of the equipment needed to protect against the hazards at the workplace.

Much of the personal protective equipment (PPE) information in this chapter is framed in general terms and is intended to complement relevant regulations and manufacturers' requirements. For more specific information, refer to the OSHA standards cited earlier.

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In some instances the standards refer to specifications by:

American National Standards Institute (ANSI)
11 West 42 Street, 13th Floor
New York, NY 10036

and

American Society for Testing and Materials (ASTM)
1916 Race Street
Philadelphia, PA 19103

Many methods of reinforcing the use of personal protective equipment have been employed. Regardless of the method, the employee should understand at the outset that his or her life may well depend upon the use of the equipment.

Using personal protective equipment requires hazard awareness and training on the part of the user. Employees must be aware that the equipment does not eliminate the hazard. If the equipment fails, exposure will occur. To reduce the possibility of failure, equipment must be properly fitted and maintained in a clean and serviceable condition.

Selection of the proper piece of personal protective equipment for the job is important. Employers and employees must understand the equipment's purpose and its limitations. The equipment must not be altered or removed even though an employee may find it uncomfortable. (Sometimes equipment may be uncomfortable simply because it does not fit properly.) Work procedures should be instituted making it a violation (resulting in termination) to modify or refuse to wear the equipment.

HAZARD ASSESSMENT AND EMPLOYEE TRAINING

§1910.132 (d), (e), (f)

In April of 1994 OSHA issued a rule updating the PPE standard to reflect current technology and improvements in personal protective equipment and to add provisions requiring employers to assess their workplaces for hazards and train their employees in the use of the protective equipment. OSHA estimates that the new standard will provide improved protection in 1.1 million work establishments covering 11.7 million employees. Upgrades in eye, face, head, foot and new hand requirements became effective July 5, 1994 and hazard assessment and training requirements on October 5, 1994. Guidance in conducting a hazard assessment of the workplace and selecting personal protective equipment is also provided.

The workplace must be assessed to determine if hazards are present which necessitate the use of PPE. The employer must verify that the assessment has been completed through a written certification which identifies the workplace, the person certifying that the evaluation has been performed, the date of the assessment, and a statement which identifies the document as certification of hazard assessment. If it is determined that such hazards are present, the employer must select protective equipment for the employees and communicate the selection decisions to them.

Hazard Assessment

PPE devices alone should not be relied on to provide protection against hazards, but should be used in conjunction with guards, engineering controls, and sound manufacturing practices.

It is necessary to consider certain general guidelines for assessing the foot, head, eye and face, and hand hazard situations that exist in an occupational or educational operation or process, and to match the protective devices to the particular hazard. It should be the responsibility of the safety officer to exercise common sense and appropriate expertise to accomplish these tasks.

Assessment Guidelines

The employer must conduct a walk-through survey of the areas in question to identify sources of hazards to workers. These hazardous situations may include sources of motion; sources of high temperatures; types of

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chemical exposures; sources of harmful dust or light radiation; sources of falling objects or potential for dropping objects; sources of sharp objects which might pierce the feet or cut the hands and rolling or pinching objects which could crush the feet; the layout of workplace and location of co-workers; and any electrical hazards.

Following the walk-through survey, it is necessary to organize the data to prepare an analysis of the hazards to enable proper selection of protective equipment. The employer should analyze the data on the workplace and estimate the potential for injuries. Each of the basic hazards should be reviewed and a determination made as to the type, level of risk, and seriousness of potential injury from each of the hazards found in the area. The possibility of exposure to several hazards simultaneously should be considered.

Selection Guidelines

After completion of the hazard assessment, the general procedure for selection of protective equipment is to:

1. Become familiar with the potential hazards and the type of protective equipment that is available, and what it can do;
2. Compare the hazards associated with the environment;
3. Select the protective equipment which ensures a level of protection greater than the minimum required to protect employees from the hazards;
4. Fit the user with the protective device and give instructions on care and use of the PPE. It is very important that the users be made aware of all warning labels for and limitations of their PPE.

Careful consideration must be given to comfort and fit. PPE that fits poorly will not afford the necessary protection. Continued wearing of the device is more likely if it fits the wearer comfortably and protective devices are generally available in a variety of sizes.

Adjustments should be made on an individual basis for a comfortable fit that will maintain the protective device in the proper position. Particular care should be taken in fitting devices for eye protection against dust and chemical splashes. In addition, proper fitting of helmets is important to ensure that it will not fall off during work operations.

It is the responsibility of the employer or safety officer to reassess the workplace hazard situation as necessary, to identify and evaluate new equipment and processes, to review accident records, and reevaluate the suitability of previously selected PPE.

Employee Training

Employers must provide training for each employee who is required to use personal protective equipment. Training should include *when* PPE is necessary; *what* PPE is necessary; *how to wear* PPE; its limitations; the proper care, maintenance, useful life, and disposal of the PPE. Employees must demonstrate an understanding of the training and the ability to use the PPE properly before being allowed to perform work requiring the use of the equipment.

If an employer has reason to believe an employee does not have the understanding or skill required, the employer must retrain. Circumstances where retraining may be required include changes in the workplace or changes in the types of PPE to be used which would render previous training obsolete. Also, inadequacies in an affected employee's knowledge or use of the assigned PPE which indicates that the employee has not retained the necessary understanding or skills. Employers must certify in writing that the employee has received and understands the training.

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Cleaning and maintenance

It is important that all PPE be kept clean and properly maintained. Cleaning is particularly important for eye and face protection where dirty or fogged lenses could impair vision. PPE should be inspected, cleaned, and maintained at regular intervals so that the PPE provides the requisite protection.

It is also important to ensure that contaminated PPE which cannot be decontaminated is disposed of in a manner that protects employees from exposure to hazards.

This chapter discusses those types of personal protective equipment most commonly used for protection of the head, including eyes and ears; the torso; arms and hands; and feet. The use of equipment to protect against life-threatening hazards is also discussed.

Head protection

§1910.135

Head injuries are usually caused by the impact and penetration of falling or flying objects, or by bumping against a fixed object. Injuries also occur when workers' unprotected heads come in contact with exposed electrical conductors. Wearing a protective helmet lessens the chance of a serious head injury when objects such as small tools, pieces of wood, stones, or sparks from overhead work come in contact with the head.

Preventing head injuries is an important factor in every safety program. A survey by the Bureau of Labor Statistics (BLS) of accidents and injuries noted that most workers who suffered impact injuries to the head were not wearing head protection. The majority of those workers were injured while performing their normal jobs at their regular worksites.

The BLS survey showed that most employers of people injured did not require workers to wear head protection. Of those wearing hard hats, all but five percent indicated that they were required by their employers to wear them. It was found that the vast majority who wore them all or most of the time at work felt that hard hats were practical in their jobs.

Identification, then elimination or control of a hazard that could lead to an accident, is the first step to take. However, many accidents that cause head injuries are difficult to anticipate and control. Where hazardous situations exist, the employer must provide head protection to eliminate injury. The best practice to follow is, wherever the potential for dangerous conditions exists, wear head protection.

Types of head protection

Head injuries are caused by falling or flying objects, or by bumping the head against a fixed object. Head protection, in the form of a protective helmet, must do two things—resist penetration and absorb the shock of a blow. This is achieved by making the helmet's shell of a material hard enough to resist the blow, and by using a shock-absorbing lining made up of a headband and crown straps to keep the shell away from the wearer's skull. The outer shell will:

- Absorb the force of impact,
- Deflect falling or flying items,
- Prevent sharp objects from penetrating the skull, and
- Protect the front, sides, and back of the head.

The shock-absorbing lining forms a suspension system consisting of a headband and crown straps that hold the suspension system to the shell. This system spreads the force of impact over a wider area of the head.

All materials that come in contact with the wearer's head must be non-irritating to normal skin. Observe all manufacturer's instructions regarding precautions and limitations of the helmets you choose.

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Helmet markings

While OSHA's head protection standard does not spell out the criteria that protective helmets must meet to provide maximum protection, it does require that helmets conform to the performance criteria of the American National Standard, ANSI Z89.1.

This industry consensus standard describes the types and classes, materials, performance requirements, and tests that manufacturers have to meet to ensure that their helmets provide adequate protection. Each helmet must be marked with the following information:

- Name and/or identification mark of the manufacturer;
- Date of manufacture;
- ANSI designation;
- Type and class designation; and
- Appropriate headband size range.

If any of this information is missing or obliterated, the helmet should not be worn.

All protective helmets purchased after July 5, 1994 must comply with the American National Standards Institute (ANSI) Z89.1-1986 *American National Standard for Personnel Protection—Protective Headwear for Industrial Workers-Requirements*. Equipment purchased prior to the July date must comply with the ANSI Z89.1-1969 *American National Standard Safety Requirements for Industrial Head Protection* and ANSI Z89.2-1971 *Requirements for Industrial Protective Helmets for Electrical Workers*.

These industry standards should be consulted for details. Later editions of the standards are available and acceptable for use.

Helmet types and classes

Protective helmets are classified according to the impact and electrical performance requirements they are designed to meet. In 1997, ANSI updated its head protection standard and changed the type and class designations of protective helmets.

Type: The old designations of Type 1 (hats) and Type 2 (caps) are no longer used. Performance requirements for the new Type 1 helmet are equivalent to those specified in the 1986 standard. Type 2 helmet performance requirements include protection from impact to the front, back and sides as well as the top; off-center penetration resistance; and chin strap retention.

Classification: New electrical insulation classifications have replaced the 1986 classifications. They are Class G (general), Class E (electrical), and Class C (conductive-no electrical protection). These classes replace the 1986 classifications of A, B and C respectively.

Types and classes-ANSI Z89.1-1986

Type	Protective helmet
1	Helmet with full brim, not less than 1.25 inches wide.
2	Brimless helmet with a peak extending forward from the crown.

Class	Protective helmet
A	Intended for protection against impact hazards and provide limited voltage protection.
B	Provide impact and penetration protection from falling or flying objects and from high-voltage shock and burn. Used extensively by electrical workers.
C	Designed specifically for light-weight comfort and impact protection. Offers no dielectric protection, often referred to as a "bump cap."

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Types and classes-ANSI Z89.1-1997

Type	Impact
1	Helmets intended to reduce the force of impact resulting from a blow only to the top of the head.
2	Helmets intended to reduce the force of impact resulting from a blow which may be received off center or to the top of the head.

Electrical class	Protective helmet
G (General)	Class G helmets are intended to reduce the danger of contact exposure to low voltage conductors. Test samples are proof-tested at 2,200 volts (phase to ground). However, this voltage is not intended as an indication of the voltage at which the helmet protects the wearer.
E (Electrical)	Class E helmets are intended to reduce the danger of exposure to high voltage conductors. Test samples are proof-tested at 20,000 volts (phase to ground). However, this voltage is not intended as an indication of the voltage at which the helmet protects the wearer.
C (Conductive)	Class C helmets are not intended to provide protection against contact with electrical conductors.

Proper fit

Helmets are available in either "one size fits all" or individually adjustable. To provide the best protection, a safety helmet must fit properly to ensure that it will not fall off during work operations.

Headband

The headband is the part of the harness that encircles the head. It should be adjustable in at least 1/8-hat size increments.

- Adjust the headband to the proper size so there is adequate clearance between the shell and the headband and space to allow ventilation.
- If a sweatband is used, it must cover at least the forehead portion of the headband.

Chin and nape straps

The chinstrap is an adjustable strap that fits under the chin and attaches to the helmet. A nape strap fits behind the head. These straps may be necessary to keep the helmet on the worker's head.

- Adjust the straps so they remain in place and the helmet stays firmly on the head.
- The strap should, however, break at a reasonably low force to prevent a strangulation hazard.

Care and maintenance

Clean the shell with hot water and a mild detergent, then rinse with clear water. When the helmet is dry, check for signs of cracks, penetration, or other damage due to rough treatment or wear. It's a good idea to inspect the helmet daily, or prior to each use. If the helmet is damaged, it should not be worn.

Consult the manufacturer before painting a helmet shell or using a solvent to clean it. Some paints and solvents may damage the shell and reduce its protective level.

Holes should never be drilled or punched in a helmet shell for ventilation. This only serves to reduce the helmet's ability to sustain impact. Class E helmets must never have holes drilled in the shell or any added accessory that contains metal.

Do not store a safety helmet on the rear window shelf of a vehicle. Overexposure to ultraviolet light such as sunlight and extreme heat may cause the shell to deteriorate.

A snug fitting helmet liner can be worn to protect the head, ears, and neck in cold weather.

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Eye and face protection §1910.133

Employees must use appropriate eye or face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation. Eye protection with side protectors is required where there is a hazard from flying objects. Workers who wear contact lenses must wear eye protection over the lenses. Eye and face PPE must be distinctly marked to facilitate identification of the manufacturer. Filtered lenses must be the appropriate shade number for the work being performed.

Protective eye and face devices purchased after July 5, 1994 must comply with ANSI Z87.1-1989 or be demonstrated to be equally effective. Devices purchased before that date must comply with ANSI Z87.1-1968 or be equally effective. See the regulations for a chart which provides general guidance for the proper selection of eye and face protection against hazards associated with the listed hazard "source" operations.

Eye and face protective equipment is required by OSHA where there is a reasonable probability of preventable injury when such equipment is used. Employers must provide a type of protector suitable for work to be performed and employees must use the protectors. These stipulations apply also to supervisors, management personnel, and should apply to visitors while they are in hazardous areas.

The BLS study found that about 60 percent of workers who suffered eye injuries were not wearing eye protective equipment. When asked why they were not wearing face protection at the time of the accident, workers indicated that face protection was not normally used or practiced in their type of work, or it was not required for the type of work performed at the time of the accident.

Suitable eye protectors must be provided where machines or operations present the hazard of flying objects, glare, liquids, injurious radiation, or a combination of these hazards. Protectors must meet the following minimum requirements:

- Provide adequate protection against particular hazards for which they are designed;
- Be reasonably comfortable when worn under the designated conditions;
- Fit snugly without interfering with the movements or vision of the wearer;
- Be durable;
- Be capable of being disinfected;
- Be easily cleanable; and
- Be kept clean and in good repair.

The National Society to Prevent Blindness recommends that emergency eyewashes be placed in all hazardous locations. First-aid instructions should be posted close to such potential danger spots since any delay to immediate aid or an early mistake in dealing with an eye injury can result in lasting damage.

Selection

Each eye, face, or face-and-eye protector is designed for a particular hazard. In selecting the protector, consideration should be given to the kind and degree of hazard, and the protector should be selected on that basis. Where a choice of protectors is given, and the degree of protection required is not an important issue, worker comfort may be a deciding factor. The BLS survey showed that few workers ever complained about poor vision or discomfort with personal eye equipment.

The survey noted that the typical injury was caused by flying or falling blunt metal objects. Lacerations, fractures, broken teeth, and contusions were common types of injuries reported.

Persons using corrective spectacles and those who are required by OSHA to wear eye protection must wear face shields, goggles, or spectacles of one of the following types:

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- Spectacles with protective lenses providing optical correction;
- Goggles worn over corrective spectacles without disturbing the adjustment of the spectacles; or
- Goggles that incorporate corrective lenses mounted behind the protective lenses.

When limitations or precautions are indicated by the manufacturer, they should be transmitted to the user and strictly observed.

Over the years many types and styles of eye and face-and-eye protective equipment have been developed to meet the demands for protection against a variety of hazards.

Goggles come in a number of different styles: eyecups, flexible or cushioned goggles, plastic eyeshield goggles, and foundrymen's goggles. Goggles are manufactured in several styles for specific uses such as protecting against dust and splash, and in chipper's, welder's, and cutter's models.

Safety spectacles require special frames. Combinations of normal streetwear frames with safety lenses are not in compliance.

Many hard hats and nonrigid helmets are designed with face and eye protective equipment.

Design, construction, testing, and use of eye and face protection must be in accordance with ANSI Z87.1-1968 if the equipment was purchased before July 5, 1994 and in accordance with ANSI Z87.1-1989 if the devices were purchased after July 5, 1994.

Fitting

Fitting of goggles and safety spectacles should be done by someone skilled in the procedure. Prescription safety spectacles should be fitted only by qualified optical personnel.

Inspection and maintenance

It is essential that the lenses of eye protectors be kept clean. Continuous vision through dirty lenses can cause eye strain—often an excuse for not wearing the eye protectors. Daily inspection and cleaning of the eye protector with soap and hot water, or with a cleaning solution and tissue, is recommended.

Pitted lenses, like dirty lenses, can be a source of reduced vision. They should be replaced. Deep scratches or excessively pitted lenses are apt to break more readily.

Slack, worn-out, sweat-soaked, or twisted headbands do not hold the eye protector in proper position. Visual inspection can determine when the headband elasticity is reduced to a point beyond proper function.

Goggles should be kept in a case when not in use. Spectacles, in particular, should be given the same care as one's own glasses, since the frame, nose pads, and temples can be damaged by rough usage.

Personal protective equipment which has been previously used should be disinfected before being issued to another employee. Even when each employee is assigned protective equipment for extended periods, it is recommended that such equipment be cleaned and disinfected regularly.

Several methods for disinfecting eye-protective equipment are acceptable. The most effective method is to disassemble the goggles or spectacles and thoroughly clean all parts with soap and warm water. Carefully rinse all traces of soap, and replace defective parts with new ones.

Swab thoroughly or completely immerse all parts for 10 minutes in a solution of germicidal deodorant fungicide. Remove parts from solution and suspend in a clean place for air drying at room temperature or with heated air. Do not rinse after removing parts from the solution because this will remove the germicidal residue which retains its effectiveness after drying.

The dry parts or items should be placed in a clean, dust-proof container, such as a box, bag, or plastic envelope, to protect them until reissue.

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Eye and face protection selection chart

Source	Assessment of hazard	Protection
Impact — Chipping, grinding machining, masonry work, woodworking, sawing, drilling, chiseling, powered fastening, riveting, and sanding.	Flying fragments, objects, large chips, particles sand, dirt, etc.	Spectacles with side protection, goggles, face shields. See notes (1), (3), (5), (6), (10). For severe exposure, use faceshield.
Heat — Furnace operations, pouring, casting, hot dipping, and welding.	Hot sparks	Faceshields, goggles, spectacles with side protection. For severe exposure use faceshield. See notes (1), (2), (3).
	Splash from molten metals	Faceshields worn over goggles. See notes (1), (2), (3).
	High temperature exposure	Screen face shields, reflective face shields. See notes (1), (2), (3).
Chemicals — Acid and chemicals handling, degreasing plating.	Splash	Goggles, eyecup and cover types. For severe exposure, use face shield. See notes (3), (11).
	Irritating mists	Special-purpose goggles.
Dust — Woodworking, buffing, general dusty conditions.	Nuisance dust	Goggles, eyecup and cover types. See note (8).
Light and/or radiation —		
Welding: Electric arc	Optical radiation	Welding helmets or welding shields. Typical shades: 10-14. See notes (9), (12).
Welding: Gas	Optical radiation	Welding goggles or welding faceshield. Typical shades: gas welding 4-8, cutting 3-6, brazing 3-4. See note (9).
Cutting, torch brazing, torch soldering	Optical radiation	Spectacles or welding faceshield. Typical shades, 1.5-3. See notes (3), (9).
Glare	Poor vision	Spectacles with shaded or special-purpose lenses, as suitable. See notes (9), (10).

Notes to eye and face protection selection chart:

(1) Care should be taken to recognize the possibility of multiple and simultaneous exposure to a variety of hazards. Adequate protection against the highest level of each of the hazards should be provided. Protective devices do not provide unlimited protection.

(2) Operations involving heat may also involve light radiation. As required by the standard, protection from both hazards must be provided.

(3) Faceshields should only be worn over primary eye protection (spectacles or goggles).

(4) As required by the standard, filter lenses must meet the requirements for shade designations in §1910.133(a)(5). Tinted and shaded lenses are *not* filter lenses unless they are marked or identified as such.

(5) As required by the standard, persons whose vision requires the use of prescription (Rx) lenses must wear either protective devices fitted with prescription (Rx) lenses or protective devices designed to be worn over regular prescription (Rx) eyewear.

(6) Wearers of contact lenses must also wear appropriate eye and face protection devices in a hazardous environment. It should be recognized that dusty and/or chemical environments may represent an additional hazard to contact lens wearers.

(7) Caution should be exercised in the use of metal frame protective devices in electrical hazard areas.

(8) Atmospheric conditions and the restricted ventilation of the protector can cause lenses to fog. Frequent cleansing may be necessary.

(9) Welding helmets or faceshields should be used only over primary eye protection (spectacles or goggles).

(10) Non-sideshield spectacles are available for frontal protection only, but are not acceptable eye protection for the sources and operations listed for "impact."

(11) Ventilation should be adequate, but well protected from splash entry. Eye and face protection should be designed and used so that it provides both adequate ventilation and protects the wearer from splash entry.

(12) Protection from light radiation is directly related to filter lens density. See note (4). Select the darkest shade that allows task performance.

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Hearing protection §1910.95

Exposure to high noise levels can cause hearing loss or impairment. It can create physical and psychological stress. There is no cure for noise-induced hearing loss, so the prevention of excessive noise exposure is the only way to avoid hearing damage. Specifically designed protection is required, depending on the type of noise encountered.

Preformed or molded ear plugs should be individually fitted by a professional. Waxed cotton, foam, or fiberglass wool earplugs are self-forming. When properly inserted, they work as well as most molded earplugs.

Some earplugs are disposable, to be used one time and then thrown away. The non-disposable type should be cleaned after each use for proper protection. Plain cotton is ineffective as protection against hazardous noise.

Earmuffs need to make a perfect seal around the ear to be effective. Glasses, long sideburns, long hair, and facial movements, such as chewing, can reduce protection. Special equipment is available for use with glasses or beards.

For extremely noisy situations, earplugs should be worn in addition to earmuffs. When used together earplugs and earmuffs change the nature of sounds; all sounds are reduced including one's own voice, but other voices or warning signals are easier to hear.

Maintenance

Disposable and reusable earplugs:

- Wash hands and inspect plugs before insertion;
- Wash reusable plugs daily and store in a clean case;
- Replace plugs that are hard or discolored as soon as possible;
- Make sure the plug fits properly inside the ear canal. If done correctly, the wearer's voice will sound louder to him/her; and
- With headband plugs, do not bend or twist the band.

Earmuffs:

- Check cushions with each use and wash them as needed; and
- Ensure that there is a tight fit as loose muffs will not reduce the noise.

For more specific information on a hearing conservation program see Title 29 CFR 1910.95 Occupational Noise Exposure.

Torso protection

Many hazards can threaten the torso: heat, splashes from hot metals and liquids, impacts, cuts, acids, and radiation. A variety of protective clothing is available: vests, jackets, aprons, coveralls, and full body suits.

Selection

Wool and specially treated cotton are two natural fibers which are fire-resistant and comfortable since they adapt well to changing workplace temperatures.

Duck, a closely-woven cotton fabric, is good for light duty protective clothing. It can protect against cuts and bruises on jobs where employees handle heavy, sharp, or rough material.

Heat-reflecting clothing such as leather is often used to guard against dry heat and flame. Rubber and rubberized fabrics, neoprene, and plastics give protection against some acids and chemicals.

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Disposable suits of paper-like material are particularly important for protection from dusty materials or materials that can splash. If the substance is extremely toxic, a completely enclosed suit may be necessary. The clothing should be inspected to assure proper fit and function for continued protection.

Hand protection

§1910.138

Employers must select and require employees to use appropriate hand protection when employees' hands are exposed to hazards such as those from skin absorption of harmful substances; severe cuts or lacerations; severe abrasions; punctures; chemical burns; thermal burns and harmful temperature extremes.

Employers must base the selection of the appropriate hand protection on evaluation of the performance characteristics of the hand protection relative to the tasks to be performed, conditions present, duration of use and the hazards and potential hazards identified.

Gloves are often relied upon to prevent cuts, abrasions, burns, and skin contact with chemicals that are capable of causing local or systemic effects following dermal exposure. OSHA is unaware of any gloves that provide protection against all potential hand hazards, and commonly available glove materials provide only limited protection against many chemicals. Therefore, it is important to select the most appropriate glove for a particular application and to determine how long it can be worn, and whether it can be reused.

It is also important to know the performance characteristics of gloves relative to the specific hazard anticipated. These performance characteristics should be assessed by using standard test procedures. Before purchasing gloves, the employer should request documentation from the manufacturer that the gloves meet the appropriate test standard(s) for the hazard(s) anticipated.

Other factors to be considered for glove selection in general include:

- As long as the performance characteristics are acceptable, in certain circumstances, it may be more cost effective to regularly change cheaper gloves than to reuse more expensive types; and
- Work activities of the employee should be studied to determine the degree of dexterity required, the duration, frequency, and degree of exposure of the hazard, and the physical stresses that will be applied.

With respect to selection of gloves for protection against chemical hazards:

- Toxic properties of the chemical(s) must be determined;
- Generally, any "chemical resistant" glove can be used for dry powders;
- For mixtures and formulated products (unless specific test data is available), a glove should be selected on the basis of the chemical component with the shortest breakthrough time, since it is possible for solvents to carry active ingredients through polymeric materials; and
- Employees must be able to remove the gloves in such a manner as to prevent skin contamination.

Maintenance

It is important to wash hands often to prevent a build-up of sweat and dirt. It is this combination that can cause skin irritation for the glove wearer. Check gloves for cracks and holes, especially at the tips and between the fingers and replace worn or damaged gloves promptly. Keep gloves clean and dry as much as practical and it's a good idea to keep a spare pair of gloves for unexpected damage or loss.

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Other types of hand protection

Finger cots that protect a single finger or fingertip.

Mitts with two divisions, one for the thumb and another for the fingers.

Thimbles that protect the thumb or the thumb and first two fingers.

Hand pads that protect the palm of the hand from cuts, friction, and burns from hot objects. These can't be used when manual dexterity is required.

Sleeves or forearm cuffs protect the arms and wrists from heat, splashing liquids, impact, and cuts.

Hand lotions and barrier creams are best used with gloves or finger protection and should not be considered a substitute for gloves.

Protection factors

Type of glove	Protection
Rubber	Acids, bases, caustics, solvents, diluted-water solutions of chemicals, alcohol—high resistance to cuts
Canvas or cloth	Dirt, wood splinters, sharp edges
Metal mesh	High resistance to cuts and scratches
Insulated	Electrical charges
Heat-resistant	Heat and flames
Lead-lined	Radiation
Hypo-allergenic and powder-free	Skin problems in workers with allergies
Cuffed	Liquids trickling down into the glove
Nitrile (synthetic rubber)	Oils, many solvents, esters, grease and animal fat—high resistance to cuts and abrasions
Neoprene	Broad range of chemicals, oils, acids, caustics and solvents—less resistant to cuts, punctures and abrasions than nitrile
Polyvinyl chloride (PVC)	Acids, caustics, alkalis, bases and alcohol—good abrasion and cut resistance (some types are susceptible to cuts)
Polyvinyl alcohol (PVA)	Aromatics, chlorinated solvents, esters and most ketones—resists cuts, punctures and abrasion (PVA breaks down when exposed to water and light alcohol)
Ethylene vinyl alcohol (EVOH) also called flat film gloves	Highly resistant to chemicals and hazardous materials—little resistance to cuts and tears (usually worn as a liner under PVC or nitrile gloves)
Butyl	Acetone and dimethyl formamide—not useful against cuts, punctures, and abrasions
Vitron	Benzene, methylene chloride and carbon disulfide—little resistance to cuts, punctures, and abrasions

Electrical protective equipment §1910.137

In January of 1994, OSHA issued a rule revising the electrical protective equipment requirements in its general industry standards. The current standards for design of such equipment adopt several national consensus standards by reference. The revision replaces the incorporation of these out-of-date consensus standards with a set of up-to-date performance-oriented requirements.

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Rubber protective equipment for electrical workers must conform to the requirements established by the American Society for Testing and Materials (ASME) as specified in the following list:

Rubber insulating gloves	ASTM D120-87
Rubber insulating matting	ASTM D178-93 (or D178-88)
Rubber insulating blankets	ASTM D1048-93 (or D1048-88a)
Rubber insulating covers	ASTM D1049-93 (or D1049-88)
Rubber insulating line hose	ASTM D105-90
Rubber insulating sleeves	ASTM D1051-87

Foot protection**§1910.136**

Employees must wear protective footwear when working in areas where there is a danger of foot injuries due to falling or rolling objects, or objects piercing the sole, and where employees' feet are exposed to electrical hazards.

Protective footwear purchased after July 5, 1994 must comply with ANSI Z41-1991 or be equally effective. Protective footwear purchased before that date must comply with ANSI Z41.1-1967 or be equally effective.

Safety shoes and boots which meet the ANSI Z41-1991 standard provide both impact and compression protection. Where necessary, safety shoes can be obtained which provide puncture protection. In some work situations, metatarsal protection should be provided, and in other special situations electrical conductive or insulating safety shoes would be appropriate.

Safety shoes or boots with impact protection would be required for carrying or handling materials such as packages, objects, parts or heavy tools which could be dropped, and for other activities where objects might fall onto the feet. Safety shoes or boots with compression protection would be required for work activities involving skid trucks (manual material handling carts) around bulk rolls (such as paper rolls) and heavy pipes, all of which could potentially roll over employees' feet. Safety shoes or boots with puncture protection would be required where sharp objects could be stepped on, causing a foot injury.

According to the BLS survey, most of the workers in selected occupations who suffered impact injuries to the feet were not wearing protective footwear. Furthermore, most of their employers did not require them to wear safety shoes. The typical foot injury was caused by objects falling less than four feet and the median weight was about 65 pounds. Again, most workers were injured while performing their normal job activities at their worksites.

For protection of feet and legs from falling or rolling objects, sharp objects, molten metal, hot surfaces, and wet slippery surfaces workers should use appropriate footguards, safety shoes, or boots and leggings.

Aluminum alloy, fiberglass, or galvanized steel footguards can be worn over usual workshoes, although they present the possibility of catching on something and tripping workers. Heat-resistant soled shoes protect against hot surfaces like those found in the roofing, paving, and hot metal industries.

Leggings protect the lower leg and feet from molten metal or welding sparks. Safety snaps permit their rapid removal.

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Other foot and leg protection

Other options for protective footwear include:

- Shoes and boots with instep protection;
- Insulated boots for protection against extreme temperatures;
- Boots with built-in ankle protection;
- Rubber or plastic safety boots that are effective against water, oil, acids, corrosives, and chemicals;
- Foundry shoes with elastic gores rather than laces to provide easy removal in case sparks or hot metal get inside; and
- Add-on protections such as metatarsal guards, shoe covers, rubber spats, strap-on cleats, and puncture-proof steel inserts.

Aluminum alloy, fiberglass, or galvanized steel footguards can be worn over usual workshoes, although they present the possibility of catching on something and tripping workers.

Heat-resistant soled shoes protect against hot surfaces like those found in the roofing, paving, and hot metal industries.

Leggings protect the lower leg and feet from molten metal or welding sparks. Safety snaps permit their rapid removal.

General life-threatening hazards

Water protection

A Coast Guard-approved life jacket or buoyant work vest should be used if there is danger of falling into water while working. For emergency rescue operations, boats and ring buoys with at least 90 feet of line must be provided.

Visibility

Night workers and flagmen who might be struck by moving vehicles need suits or vests designed to reflect light.

Lifelines and safety nets

In jobs involving potential fall hazards, safety belts, lifelines, body harnesses, and/or lanyards must be used. If lifelines are used where they might be cut accidentally, they should be padded or otherwise protected. Rope should have a strength of 5,400 pounds. Lifelines should be inspected regularly to assure their perfect condition.

Lanyards should be of at least $\frac{1}{2}$ -inch nylon or the equivalent and should be short enough to allow a fall no greater than 6 feet. They must be firmly secured above the working surface. Body harnesses are recommended for fall arrest systems.

Nets should be used when a lifeline or a safety belt is not practical. Forged steel, safety hooks, or shackles should be used to fasten a net to its supports. The mesh should be no larger than 6 inches by 6 inches. The nets should extend beyond the edge of the work surface. Safety nets should be tested to ensure that they are tight enough to prevent an employee from making contact with any surface or structure below.

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Human factors in PPE

Heat stress

Wearing PPE puts a worker at considerable risk of developing heat stress. This can result in health effects ranging from transient heat fatigue to serious illness or death. Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, and the individual characteristics of the worker.

Individuals vary in their susceptibility to heat stress. Factors that may predispose someone to heat stress include:

- Lack of physical fitness
- Lack of acclimatization
- Age
- Dehydration
- Obesity
- Alcohol and drug use
- Infection
- Sunburn
- Diarrhea
- Chronic disease

Reduced work tolerance and the increased risk of excessive heat stress is directly influenced by the amount and type of PPE worn. PPE adds weight and bulk, severely reduces the body's access to normal heat exchange mechanisms (evaporation, convection, and radiation), and increases energy expenditure.

Therefore, when selecting PPE, each item's benefit should be carefully evaluated in relation to its potential for increasing the risk of heat stress. Once PPE is selected, the safe duration of work/rest periods should be determined based on the:

- Anticipated work rate
- Ambient temperature and other environmental factors
- Type of protective ensemble
- Individual worker characteristics and fitness.

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Physical Condition

Physical fitness is a major factor influencing a person's ability to perform work under heat stress. The more fit someone is, the more work he/she can safely perform.

At a given level of work, a fit person, relative to an unfit person, will have:

- Less physiological strain
- A lower heart rate
- A lower body temperature, which indicates less retained body heat (a rise in internal temperature precipitates heat injury)
- A more efficient sweating mechanism
- Slightly lower oxygen consumption
- Slightly lower carbon dioxide production

Level of Acclimatization

The degree to which a worker's body has physiologically adjusted or acclimatized to working under hot conditions affects his or her ability to do work. Acclimatized individuals generally have lower heart rates and body temperatures than unacclimatized individuals, and sweat sooner and more profusely.

This enables them to maintain lower skin and body temperatures at a given level of environmental heat and work loads than unacclimatized workers. Sweat composition also becomes more dilute with acclimatization, which reduces electrolyte loss.

COLD ENVIRONMENTS

People who work in cold temperatures such as freezer plants, meat-packing houses, cold storage facilities, lumbering, telecommunications, and electric utilities must deal with cold environments. The frequency of worker accidents is higher in cold environments because nerve impulses are inhibited and hands can stiffen and become clumsy. Temperature-related safety problems include ice, snow blindness, reflections from snow, and burns from skin contact with cold metal surfaces.

The main factors contributing to cold injury are exposure to humidity and high winds, contact with wetness or metal, inadequate clothing, age, and general health. Contributing physical conditions include allergies, vascular disease, excessive smoking and drinking, sedative drugs, and some medicines. Cold disorders are classified as "generalized" as in hypothermia or "localized" such as frostbite.

Generalized: Hypothermia

Exposure to cold can cause the body's internal temperature to drop to a dangerously low level. This condition is known as hypothermia. It can occur at temperatures above freezing. Cold, wet, windy conditions are ideal for causing hypothermia.

- Uncontrollable shivering
- Sensation of cold
- Inability to use the hands
- Vague, slow, or slurred speech
- Memory lapses or forgetfulness
- Frequent stumbling
- Incoherence and drowsiness

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Localized: Frostbite

Frostbite occurs when the body extremities do not receive sufficient heat, either because of poor circulation or inadequate insulation. Body tissue which freezes due to exposure to extremely low temperatures results in tissue damage. The most vulnerable body parts include the nose, cheeks, ears, fingers, and toes.

- Sensation of coldness, followed by numbness
- Skin becomes bright red, then small patches of white appear as freezing actually occurs
- *A tingling, stinging, or aching feeling may follow*
- Skin becomes less elastic
- Initial pain is felt, which subsides
- Blisters may appear

Frostnip occurs when the face or extremities are exposed to a cold wind which causes the skin to turn white.

Evaluating work conditions

The effects of cold temperatures on workers can be reduced through appropriate protective clothing, heating units, and other protective devices such as:

- Heated warming shelter at work site
- General or spot heating to increase workplace temperature
- Warm air jets or radiant heaters to warm the hands of employees performing fine hand work
- *Shields for job site protection from wind and drafts*
- Metal tool handles and control bars should be covered with insulating material
- Appropriate and adequate clothing worn by workers. Dirty or greasy fabric loses much of its insulation value. Clothing should be cotton or wool, denim has poor insulating qualities. Boots, mittens or gloves should be insulated and face and head protection should be worn.
- Chemical-resistant gloves should be available for chemical handling operations

Evaluating the facility

Buildings should be evaluated for adequate protection from cold weather. Cold weather damage most often occurs in exposed, out-of-the-way areas of a facility during weekends or other shutdown periods. Failure to identify areas likely to be susceptible to cold weather damage and improper maintenance also contribute to cold weather damage.

RESPIRATORY PROTECTION

Hazards to the lungs are not always easy to detect. Some of the most common hazards are the lack of oxygen and the presence of harmful dust, fogs, smokes, mists, fumes, gases, vapors, or sprays including substances that may cause cancer, lung impairment, other diseases, or death. Respirators prevent the entry of harmful substances into the lungs during breathing. Some respirators also provide a separate supply of breathable air so work can be performed where there is inadequate oxygen, or where greater protection is needed.

The prevention of atmospheric contamination at the worksite generally should be accomplished as far as feasible by engineering control measures, such as enclosing or confining the contaminant-producing operation, exhausting the contaminant, or substituting with less toxic materials. Historically, the industrial hygiene profession has sought to control hazardous air contamination through engineering means. How-

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ever, when effective engineering controls are not feasible, while those controls are being installed, or during clean up operations, appropriate respirators must be used. The user should be aware that respirators have their limitations and are not substitutes for effective engineering controls. Where respirators are necessary for health protection, specific procedures are necessary to overcome any potential deficiencies and to assure the effectiveness of the equipment.

Employers are responsible for establishing an effective respirator program — different hazards require different respirators — and employees are responsible for wearing the respirator and complying with the program.

The plant or company department of industrial hygiene, health physics, safety engineering or fire prevention should administer the program in liaison with the plant medical department. In small plants that have no such departments, the respirator program should be administered by a suitably trained upper-level superintendent, foreman, or other qualified person responsible to the principle manager. Responsibility for the program should rest with one person. The administrator must have sufficient knowledge of the subject to supervise the program properly.

Any respirator program should stress thorough training of all participants, especially the users who need to wear the respirators. Employees must be aware that the equipment does not eliminate the hazard. If the equipment fails, overexposure will occur. To reduce the possibility of failure, equipment must fit properly and be maintained in a clean and serviceable condition.

Employers and employees must understand the equipment's purpose and its limitations. The equipment must not be altered or removed from the wearer even for a short time, despite the fact the wearer may find it uncomfortable.

An effective respirator program should include the following:

- (i) Procedures for selecting respirators for use in the workplace;
- (ii) Medical evaluations of employees required to use respirators;
- (iii) Fit testing procedures for tight-fitting respirators;
- (iv) Procedures for proper use of respirators in routine and reasonably foreseeable emergency situations;
- (v) Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining respirators;
- (vi) Procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators;
- (vii) Training of employees in the respiratory hazards to which they are potentially exposed during routine and emergency situations;
- (viii) Training of employees in the proper use of respirators, including putting on and removing them, any limitations on their use, and their maintenance; and
- (ix) Procedures for regularly evaluating the effectiveness of the program.

Written standard operating procedures

In workplaces where respirators are used in potentially hazardous atmospheres present during normal operations or emergency situations, employers are required to have worksite specific *written* operating procedures for the safe and proper use of respirators. Users must be familiar with these procedures as well as with available respirators and their limitations.

The written standard operating procedures should contain all information needed to maintain an effective respirator program to meet the user's individual requirements. They should be written so as to be useful to those directly involved in the respirator program, the program administrator, those fitting the respirators and training the workers, respirator maintenance workers, and the supervisors responsible for overseeing respirator use on the job. It is not necessary that the operating procedures be written for the wearer, although in

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a very small program it may be desirable to direct their content to the wearer. Only analysis of the individual program will show to what extent information for the wearer should be included.

The procedures should contain all information needed to ensure proper respiratory protection of a specific group of workers against a specific hazard or several particular hazards. Generally, the procedures should contain the following:

(d) *Selection of respirators.* This paragraph requires the employer to evaluate respiratory hazard(s) in the workplace, identify relevant workplace and user factors and base respirator selection on these factors. The paragraph also specifies appropriately protective respirators for use in IDLH atmospheres, and limits the selection and use of air-purifying respirators.

(e) *Medical evaluation.* Using a respirator may place a physiological burden on employees that varies with the type of respirator worn, the job and workplace conditions in which the respirator is used, and the medical status of the employee. Accordingly, this paragraph specifies the minimum requirements for medical evaluation that employers must implement to determine the employee's ability to use a respirator.

(1) *General.* the employer shall provide a medical evaluation to determine the employee's ability to use a respirator, before the employee is fit tested or required to use the respirator in the workplace. The employer may discontinue an employee's medical evaluations when the employee is no longer required to use a respirator.

(f) *Fit testing.* This paragraph requires that, before an employee may be required to use any respirator with a negative or positive pressure tight-fitting facepiece, the employee must be fit tested with the same make, model, style, and size of respirator that will be used. This paragraph specifies the kinds of fit tests allowed, the procedures for conducting them, and how the results of the fit tests must be used.

(1) The employer shall ensure that employees using a tight-fitting facepiece respirator pass an appropriate qualitative fit test (QLFT) or quantitative fit test (QNFT) as stated in this paragraph.

(2) The employer shall ensure that an employee using a tight-fitting facepiece respirator is fit tested prior to initial use of the respirator, whenever a different respirator facepiece (size, style, model or make) is used, and at least annually thereafter.

(3) The employer shall conduct an additional fit test whenever the employee reports, or the employer, PLHCP, supervisor, or program administrator makes visual observations of changes in the employee's physical condition that could affect respirator fit. Such conditions include, but are not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight.

(g) *Use of respirators.* This paragraph requires employers to establish and implement procedures for the proper use of respirators. These requirements include prohibiting conditions that may result in facepiece seal leakage, preventing employees from removing respirators in hazardous environments, taking actions to ensure continued effective respirator operation throughout the work shift, and establishing procedures for the use of respirators in IDLH atmospheres or in interior structural firefighting situations.

(h) *Maintenance and care of respirators.* This paragraph requires the employer to provide for the cleaning and disinfecting, storage, inspection, and repair of respirators used by employees.

(i) *Breathing air quality and use.* This paragraph requires the employer to provide employees using atmosphere-supplying respirators (supplied-air and SCBA) with breathing gases of high purity.

(k) *Training and information.* This paragraph requires the employer to provide effective training to employees who are required to use respirators. The training must be comprehensive, understandable, and recur annually, and more often if necessary. This paragraph also requires the employer to provide the basic information on respirators in Appendix D of this section to employees who wear respirators when not required by this section or by the employer to do so.

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- administrative procedures for:
 - purchase of approved or accepted respirator(s);
 - control of inventory of spare parts, new respirators, and respirators ready for reissue after maintenance;
 - issuance of respirators to ensure use of the proper one for a given hazard; and
 - guidance of supervisory personnel in continued surveillance of respirator use and determination of workers' exposure to respiratory hazards;
- instructions for respirator use during emergencies, including fire, which can create an atmosphere immediately hazardous to life or health
- guidelines for medical surveillance of workers, including pre-employment physical examinations to eliminate those physically or psychologically unfit to wear respirators, and periodic physical examinations to review the overall effectiveness of the respirator program on the basis of physiological factors; and
- procedures for evaluating the respirator program's effectiveness;

Obviously, the above essentially restate the OSHA requirements for a minimal acceptable respirator program. The point is that all the information needed to establish and maintain an adequate respirator program should be written down.

The exact format of written standard operating procedures may vary widely. The large user who has many workers wearing respirators and, perhaps, several respiratory hazards to consider, may formulate separate procedures for selection and use of respirators for each hazard. For a small user, who has only a few workers to protect from only one or very few hazards, a much simplified document may serve; but it must cover the same subjects. In general, the complexity of the procedures increases as respirator use increases. The procedures also become more extensive as the toxicity of the respiratory hazard(s) increases, demanding better and more reliable protection. It is better to be overly detailed in developing written operating procedures than not detailed enough.

When practical, a respirator should be assigned to each worker for exclusive use, and should be permanently marked to indicate to whom it is assigned. Care should be taken to ensure that the marking does not affect the respirator performance. If possible, records should be kept on the issuance and use of each respirator. To do so, each should be permanently identified. Records should include the date of initial issue, the dates of reissue, and a listing of repairs.

Particularly important are procedures for respirator use during emergencies such as fire, large spillage of toxic material, accidental releases of a potentially lethal substance, or failure of a ventilation system. All possible emergencies should be considered in advance and prepared for in the written procedure. In the stress of an emergency, memories may be faulty. Furthermore, these emergency procedures should be used in training emergency response teams.

Program Evaluation

The effectiveness of a company's respirator program should be evaluated as necessary and the written operating procedure modified as necessary to reflect the evaluation results. The use of a labor-management team may be effective for the periodic evaluation. A sample respirator program checklist for evaluating the program may be found in Appendix B.

Selection

Choosing the right equipment involves several steps: determining what the hazard is and its extent, choosing equipment that is certified for the function, and assuring that the device is performing the intended function. The proper selection of respirators must be made according to the guidance of American National Standards Institute (ANSI) publication, "Practices for Respiratory Protection," ANSI Z88.2-1969 (A later edition of this standard, Z88.2-1980, has been issued by ANSI.)

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Chemical and physical properties of the contaminant, as well as the toxicity and concentration of the hazardous material and the amount of oxygen present, must be considered in selecting the proper respirators. The nature and extent of the hazard, work rate, area to be covered, mobility, work requirements and conditions, as well as the limitations and characteristics of the available respirators also are selection factors.

There are two basic classes of respirators: air purifying and atmosphere supplying. Air-purifying respirators use filters or sorbents to remove harmful substances from the air. They range from simple disposable masks to sophisticated powered air-purifying respirators. Air-purifying respirators do not supply oxygen and may not be used in oxygen-deficient atmospheres or in ones that are immediately dangerous to life or health (IDLH). Atmosphere-supplying respirators are designed to provide breathable air from a clean air source other than the surrounding contaminated work atmosphere. They range from supplied-air respirators and self-contained breathing apparatus (SCBAs) to complete air-supplied suits.

The time needed to perform a given task, including the time necessary to enter and leave a contaminated area, is one factor that determines the type of respiratory protection needed. For example, an SCBA, gas mask, or air-purifying chemical-cartridge respirator provides respiratory protection for relatively short periods; whereas a type of atmosphere-supplying respirator that supplies breathable air from an air compressor through an air line can provide protection for extended periods of time. Particulate filter air-purifying respirators can provide protection for long periods without the need of filter replacement only if the total concentration of atmospheric particulates is low. Where there are higher concentrations of contaminants, however, an atmosphere-supplying respirator such as the positive pressure supplied-air respirator (SAR) offers the advantage of better protection and longer duration.

The use of SARs also avoids the need to be concerned about the sensory warning properties of the airborne toxic materials, a factor that must be considered when using air-purifying respirators. These respirators also cause less discomfort than air-purifying respirators because the wearer need not overcome filter resistance when inhaling.

Air-purifying respirators present minimal interference with the wearer's movement, whereas atmosphere-supplying respirators may restrict movement and present potential hazards. For example, SARs with their trailing hoses can limit the area the wearer can cover and may present a potential hazard where the trailing hose can come into contact with machinery. Similarly, and SCBA — a respirator that includes a back-mounted, compressed-air cylinder — presents both a size and weight penalty. This may restrict climbing and movement in tight places, and carrying the added weight of the air cylinder presents an additional physical burden.

Another factor to consider when using respirators is the air-supply rates. The wearer's work rate determines the volume of air breathed per minute. The volume of air supplied to meet the breathing requirements is of great significance when using atmosphere-supplying respirators such as self-contained and air-line respirators that use cylinders because this volume determines their operating life. The useful service life of these respirators under even moderate working conditions may be significantly less than under conditions of rest.

The peak airflow rate is also important in the use of a constant-flow SAR. The air-supply rate should always be greater than the maximum amount of air being inhaled in order to maintain the respiratory enclosure under positive pressure.

Higher breathing resistance of air-purifying respirators under conditions of heavy work may result in distressed breathing. A person working in an area of high temperature or humidity is under stress. Additional stress resulting from the use of a respirator should be minimized by using one having a minimal weight and minimal breathing resistance when these can be fitted properly to the wearer.

Some type of warning on the remaining service life is available for all SCBAs and for some chemical canister respirators. This may be a pressure gauge or timer with an audible alarm for SCBAs or a color end-of-service-life indicator on the cartridge or canister. The user should understand the operation and limitations of each type of warning device. Most other gas masks and chemical-cartridge respirators have no indicator for remaining service life. It is important, therefore, that new canisters and cartridges be used at the beginning of each work shift.

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Selection of Respirators

(This table presents a simplified version of characteristics and factors used for respirator selection. It does not specify the contaminant concentrations or particle size.)

Hazard	Respirator
1. Oxygen Deficiency Immediately dangerous to life or health* Not immediately dangerous to life or health	Any positive-pressure SCBA. Combination positive-pressure SAR with auxiliary self-contained air supply. Any positive-pressure SCBA or supplied-air respirator.
2. Gas and vapor contaminants Immediately dangerous to life or health* Not immediately dangerous to life or health	Positive-pressure SCBA. Combination positive-pressure SAR with auxiliary self-contained air supply. Any positive-pressure SAR. Gas mask. Chemical cartridge respirator.
3. Particulate contaminants	Any positive-pressure SAR including abrasive blasting respirator. Powered air-purifying respirator equipped with high-efficiency filters. Any air-purifying respirator with a specific particulate filter.
4. Gaseous and particulate contaminants Immediately dangerous to life or health* Not immediately dangerous to life or health	Positive-pressure SCBA. Combination positive-pressure SAR with auxiliary self-contained air supply. Any positive-pressure supplied-air respirator. Gas mask. Chemical-cartridge respirator.
5. Escape from contaminated atmosphere that may be immediately dangerous to life or health*	Any positive-pressure SCBA. Gas mask. Combination positive-pressure SAR with escape SCBA.
6. Fire fighting	Any positive-pressure SCBA.

*Note: "Immediately dangerous to life or health" is any condition that poses either an immediate threat to life or health or an immediate threat of severe exposure to contaminants, such as radioactive materials, which are likely to have adverse delayed effects on health.

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Training

Both supervisors and workers must be taught the proper selection, use, and maintenance of respirators.

All employees required to use respiratory protective equipment must be instructed in the proper use of the equipment and its limitations. Those employees who will be required to use respiratory protective equipment in atmospheres immediately dangerous to life or health should be trained in rescue procedures.

The training, conducted by a competent person, must include instructions of fitting and on how to check the facepiece-to-face seal. The employee must be given an opportunity to handle the respirator, wear it in normal air for a period of time to become familiar with it and to practice adjusting it, and then wear it in a test atmosphere.

Training should include an explanation of the following:

- Nature of the respiratory hazard and what may happen if the respirator is not used properly,
- Engineering and administrative controls being used and the need for the respirator as added protection,
- Reason(s) for selection of a particular type of respirator,
- Limitations of the selected respirator,
- Methods of donning the respirator and checking its fit and operation,
- Proper wear of the respirator,
- Respirator maintenance and storage, and
- Proper method for handling emergency situations.

Users should know that improper respirator use or maintenance may cause overexposure. They should know that continued use of poorly fitted and maintained respirators can also cause chronic disease or death from overexposure to air contaminants.

Fit Testing

Full facepieces, half masks, quarter masks and even the different brands of the same type of respirator marketed, have different fit characteristics. No one respirator will fit everyone. Employers will find it advantageous to purchase several brands of each type in various sizes to assure proper fit for all workers who must wear one.

Corrective glasses worn by employees also present a problem when fitting respirators. Special mountings are available to hold corrective lenses inside full facepieces. If corrective lenses are needed, the facepiece and lenses must be fitted by a qualified individual to provide good vision, comfort, and proper sealing.

The user must receive fitting instructions including demonstrations and practice in how to wear the respirator, how to adjust it, and how to determine if it fits properly.

Although respirators are designed for maximum efficiency, they cannot provide protection without a tight seal between the facepiece and wearer. Consequently, beards and other facial hair can substantially reduce the effectiveness of a respirator. The absence of dentures can seriously affect the fit of a facepiece. To assure proper respiratory protection, a facepiece must be checked each time the respirator is worn. This can be accomplished by performing either a positive-pressure or negative-pressure check. Detailed instructions for performing these tests can be found in the respiratory protection standard.

The effectiveness of the fit of the facepiece can be tested two ways — qualitatively and quantitatively.

Qualitative fit testing involves the introduction of a harmless odorous or irritating substance into the breathing zone around the respirator being worn. If no odor or irritation is detected, a proper fit is indicated.

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Quantitative fit testing offers the most accurate, detailed information on respirator fit. It involves the introduction of a harmless aerosol to the wearer while he or she is in a test chamber. While the wearer performs exercises that could induce facepiece leakage, the air inside and outside the facepiece is measured for the presence of the harmless aerosol to determine any leakage into the respirator.

Respirator Use Under Special Conditions

The following are special problems which may be encountered in the wearing and use of respiratory protective equipment.

A. Facial Hair

Facial hair that lies along the sealing area of the respirator, such as beards, sideburns, moustaches, or even a few days growth of stubble, should not be permitted on employees who are required to wear respirators that rely on a tight facepiece fit to achieve maximum protection. Facial hair between the wear's skin and the sealing surfaces of the respirator will prevent a good seal. A respirator that permits negative air pressure inside the facepiece during inhalation may allow leakage and, in the case of positive pressure devices, will either reduce service time or waste breathing air. A worker should not enter a contaminated work area when conditions prevent a good seal of the respirator facepiece to the face.

B. Eye Glasses

Ordinary eye glasses should not be used with full-facepiece respirators. Eye glasses with temple bars or straps that pass between the sealing surface of a full-facepiece and the worker's face will prevent a good seal, and should not be used. Special corrective lenses can be mounted inside a full-facepiece respirator and are available from all manufacturers of full-facepiece respirators. To ensure good vision, comfort, and proper sealing of the facepiece, these corrective lenses should be mounted by an individual designated by the manufacturer as qualified to install accessory items.

Eye glasses or goggles may interfere with the half facepieces. When interference occurs, a full-facepiece with special corrective lenses should be provided and worn.

C. Contact Lenses

Several factors may restrict or even prohibit the use of contact lenses while wearing any type of respiratory device. This is especially true of atmosphere-supplying respirators. With full-facepieces, incoming air directed toward the eye can cause discomfort from dirt, lint, or other debris lodging between the contact lens and the pupil.

OSHA is considering a change in their respiratory standard, with regard to use of contact lenses under respirators. Data generated by Lawrence Livermore National Laboratory is being taken into consideration.

D. Facial Deformities

Facial deformities, such as scars, deep skin creases, prominent cheekbones, severe acne, and the lack of teeth or dentures, can prevent a respirator from sealing properly.

E. Communications

Talking while wearing a respirator equipped with a facepiece may break the seal of the facepiece. When communication is necessary within a contaminated area, it should be done with the help of special communicating equipment obtained from the manufacturer of the respirator.

F. In Dangerous Atmospheres

Written procedures should be prepared for safe respirator use in immediately dangerous to life or health (IDLH) atmospheres that may occur in normal operations or emergencies. Personnel should be familiar with these procedures and respirators. At least one standby person, equipped with proper rescue equipment, including a SCBA, should be present in the nearest safe area for emergency

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rescue of those wearing respirators in an IDLH atmosphere. Communications (visual, voice, signal line, telephone, radio, or other suitable type) should be maintained among all persons present (those in the IDLH atmosphere and the standby person or persons). The respirator wearers should be equipped with safety harnesses and safety lines to permit their removal from the IDLH atmosphere if they are overcome.

Confined spaces are enclosures that are difficult to get out of, such as storage tanks, tank cars, boilers, sewers, tunnels, pipelines, pits, and tubs. The atmospheres in a confined space may be immediately dangerous to life or health because of toxic air contaminants or lack of oxygen. Before anyone enters a confined space, tests should be made to determine the presence and concentration of any flammable vapor or gas, or any toxic airborne particulate, vapor, or gas, and to determine the oxygen concentration.

The confined space should be force-ventilated to keep the concentration of a flammable substance at a safe level. No one should enter if a flammable substance exceeds the lower explosive limit. No one should enter without wearing the proper type of respirator if any air contaminant exceeds the established permissible exposure limit or if there is an oxygen deficiency. Even if the contaminant concentration is below the established breathing time-weighted average limit and there is enough oxygen, the safest procedure is to ventilate the entire space continuously and to monitor the contaminant and oxygen concentrations continuously if people are to work in the confined space without respirators.

Appropriate air-purifying respirators may be worn in a confined space only if tests show that the atmosphere contains adequate oxygen and that air contaminants are below levels immediately dangerous to life or health. While people wearing these types of respirators are in a confined space, its atmosphere should be monitored continuously.

If the atmosphere in a confined space is immediately dangerous to life or health owing to a high concentration of air contaminant or oxygen deficiency, those who must enter the space should wear a pressure-demand SCBA or a combination pressure-demand airline and self-contained breathing apparatus that always maintains positive air pressure inside the respiratory inlet covering. This is the best safety practice for confined spaces.

While personnel are in a confined space, at least one standby person with proper rescue equipment, including a SCBA, should be present outside for emergency rescue. Communications (visual, voice, signal line, telephone, radio, or other suitable type) should be maintained with those inside. Also, those inside the space should be equipped with safety harnesses and safety lines to allow their removal in case they are overcome.

G. In Low and High Temperatures

Low temperatures may fog respirator lenses. Coating the inner surface of the lens with the anti-fogging compound normally available from the respirator manufacturer should prevent fogging down to 32°F, but severe fogging may occur below 0°F. Full facepieces with nose cups that direct the warm, moist exhaled air through the exhalation valve without its touching the lens, are available. They should provide satisfactory vision at as low as -30°F. At very low temperatures, exhalation valves may freeze due to moisture. Dry respirable air should be used with airline respirators and with the type of SCBA that has an air cylinder when they are used in low temperatures.

NIOSH performs cold temperature testing on SCBA. The minimum temperature that the SCBA has been tested to and approved for is listed on the approval label.

A person working in high temperature air is under stress. Wearing a respirator causes additional stress which should be minimized by using a light-weight respirator with low breathing resistance. In atmospheres that are not immediately dangerous to life or health, the airline type supplied-air respirator is recommended. Such a respirator used in low or high temperature atmospheres may be equipped with a vortex tube to either warm or cool the air supplied.

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H. Physiological Response of Respirator Use

Wearing any respirator, alone or in conjunction with other types of protective equipment, will impose some physiological stress on the wearer. Weight of the equipment, for example, increases the energy requirement for a given task. Selection of respiratory protective devices should be based on the breathing resistance, weight of the respirator, the type and amount of protection needed as well as the individual's tolerance of the given device.

Use of respirators in conjunction with protective clothing can greatly affect the human response and endurance, especially in hot environments. Normally, in hot environments or during heavy work, the body relies a great deal on heat loss through the evaporation of sweat. With impermeable clothing, the heat loss by water evaporation is not possible. Additionally, the weight of the respirator (up to 35 pounds for a SCBA) adds to the metabolic rate of workers, increasing the amount of heat the body produces. The net effect is one of heat stress.

Based upon this limited research in this area the following recommendations are made:

1. Select the lightest weight protective ensembles and respiratory protective devices that adequately protect the worker. This will minimize the physiological demands placed on the worker by carrying the weight of this equipment.
2. If available, select protective clothing made of material that will allow evaporation of water vapor, while providing skin protection from the contaminant.
3. Reduce work rate by:
 - a. adjusting the work/rest schedules,
 - b. using automated procedures and/or mechanical assistance where possible, and
 - c. minimizing the work intensity.
4. Educate workers on the symptoms and prevention of heat illness and schedule periodic fluid replacement breaks.
5. Reduce heat stress by scheduling work at night or early morning or by providing external cooling, where possible (either through cooling garments and/or by providing cool respirable breathing air through pressure-demand air supplied respirators).
6. When conducting pipe/boiler lagging removal, ensure that steam lines are cool to minimize heat exposure from these sources.

Inspection, Cleaning, Maintenance, and Storage

All respirators must be inspected for wear and deterioration of their components before each use and during cleaning. Special attention should be given to rubber or plastic parts which can deteriorate. The facepiece, especially the face seal surface, headband, valves, connecting tube, fittings, and canister must be in good condition. A respirator inspection must include a check of the tightness of the connections.

SCBAs must be inspected at least monthly. Air and oxygen cylinders must be fully charged according to the manufacturer's instructions. Regulator and warning devices must be checked to assure their proper function.

Chemical cartridges and gas mask canisters should be replaced as necessary to provide complete protection. The manufacturer's recommendations should be followed. Mechanical filters must be replaced as necessary to avoid high resistance to breathing.

Repairs must be made only by experienced persons using parts specifically designed for the respirator. The manufacturer's instructions should be consulted for any repair, and no attempt should be made to

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repair or replace components or make adjustments or repairs beyond the manufacturer's recommendations.

A respirator that has been used must be cleaned and disinfected before it is reissued. Emergency-use rescue equipment must be cleaned and disinfected immediately after each use. Records must be kept of inspection dates and findings.

Respirators must be stored to protect against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. Protection against any mechanical damage should also be provided. Respirators should be stored so that facepieces and exhalation valves will rest in a normal position to prevent the rubber or plastic from reforming into an abnormal shape.

Respirators may be washed in a detergent solution and then sanitized by immersion in a sanitizing solution. Cleaner-sanitizers that effectively clean the respirator and contain a bactericidal agent are commercially available. The bactericidal agent frequently used is a quaternary ammonium compound. Strong cleaning and sanitizing agents and many solvents can damage rubber or elastomeric respirator parts. Such materials must be used with caution or after consultation with the respirator manufacturer.

Medical Examinations

OSHA 29 CFR 1910.134 states that no one should be assigned a task requiring use of respirators unless found physically able to do the work while wearing the respirator. In addition, some regulatory standards for specific substances and occupations may also contain requirements for medical examinations. Both types of standards declare that a physician or other licensed health care professional (PLHCP) should determine what health and physical conditions are pertinent, and that respirator wearers' medical status should be reviewed periodically.

At minimum, additional medical evaluations should be done:

- If an employee reports medical signs or symptoms related to the ability to wear the respirator;
- If a PLHCP, supervisor, or program administrator believes that the employee needs to be reevaluated;
- Observations made during fit testing and program evaluation indicate the need for reevaluation; or
- A change occurs in workplace conditions, such as physical work effort, protective clothing, or temperature, that may result in a substantial increase in the physiological burden placed on the wearer.

Pre-placement medical examinations should screen out those who are physically or psychologically unfit to wear respirators. As another part of this examination, medical tests pertinent to the respiratory hazards that workers may encounter should be made to get baseline data against which to assess physiological changes in respirator wearers. In addition, the workers' previous medical and employment history should also be considered.

The types of information which should be obtained from the worker include:

- a. *History of respiratory disease*—identifies workers with a history of asthma, emphysema, or chronic lung disease. These people may be at risk when wearing a respirator.
- b. *Work history*—identifies workers who have been exposed to asbestos, silica, cotton dust, beryllium, etc., within the past ten years, or workers who have worked in occupations or industries where such exposure was probable. If past exposures are identified, medical tests can be obtained for comparison. Some of the specific items of information which might be obtained include:
 - previous occupations;
 - problems associated with breathing during normal work activities; and
 - past problems with respirator use.

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- c. *Any other medical information*—which might offer evidence of the worker's ability or inability to wear and use respirators, such as:
- psychological problems or symptoms including claustrophobia;
 - any known physical deformities or abnormalities, including those which may interfere with respirator use;
 - past and current usage of medication; and
 - tolerance to increased heart rate, which can be produced by heat stress.

Periodic routine medical examinations should be made to determine whether respirator wearers have been exposed to harmful levels of respiratory hazards. Examination frequency should be tailored to particular situations and in accordance with specific substance standards. Tests to determine whether harmful amounts of hazardous substances have been taken into the body should be used.

These may include urine, blood, or fecal analysis and other techniques to determine the intake and excretion of toxic substances. The findings of these tests, when correlated with other exposure data, such as air sampling data for wearers of such equipment, can serve as an indication of the effectiveness of the program. Positive evidence of exposure should be followed up with appropriate surveillance of work area conditions to determine if there is any relationship to inadequate respiratory protection or a need for additional engineering controls.

Work Area Surveillance

Surveillance must be maintained of the conditions in the work area and of the degree of worker exposure or stress (combinations of work rate, environmental conditions, and physiological burdens of wearing a respirator).

Changes in operating procedures, temperature, air movement, humidity, and work practices may influence the concentration of a substance in the work area atmosphere. These factors necessitate periodic monitoring of the air contaminant concentration. Testing should continue to assure that the contaminant exposure has not risen above the maximum protective capability of the respirators being used.

Employees using SCBAs or SARs with auxiliary SCBAs in confined spaces, where the environment is or may be immediately dangerous to life or health, must wear safety harnesses and lifelines. A second person equipped with complete protective gear must be standing by ready to help if the first worker gets into trouble. Communications (visual, voice, or signal line) must be maintained with all persons present. Precautions must be taken so that in the event of an accident one person will be unaffected and have the proper rescue equipment to be able to assist the others in an emergency situation.

Air Quality Standards

Compressed air, compressed oxygen, liquid air, and liquid oxygen used for respiration must be of high purity. Oxygen must meet the requirements of the United States Pharmacopoeia for medical or breathable oxygen. Breathable air must meet at least the requirement for Type 1-Grade D breathable air described in Compressed Gas Association (CGA) Commodity Specification G-7.1-1989. Compressed oxygen must not be used in open circuit SCBAs or SARs that have previously used compressed air. Oxygen must never be used with air-line respirators.

Breathable air may be supplied to respirators from cylinders or air compressors. For testing cylinders, see Shipping Container Specifications of the Department of Transportation (49 CFR parts 173 and 178).

Containers of breathable gas must be clearly marked in accordance with NIOSH specifications.

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The compressor for supplying air must be equipped with the necessary safety devices and alarms. Compressors must be constructed and situated to avoid any entry of contaminated air into the system and must be equipped with suitable in-line, air-purifying sorbent beds and filters installed to assure air quality.

The system must also have a receiver of sufficient capacity to enable the wearer to escape from a contaminated atmosphere in the event of compressor failure and alarms to indicate compressor failure and overheating. If an oil-lubricated compressor is used, it must have a high-temperature, or carbon monoxide alarm, or both. If only the high-temperature alarm is used, the air from the compressor must be tested frequently for carbon monoxide.

Air-line couplings must be incompatible with outlets for other gas systems to prevent accidental servicing of air-line respirators with nonrespirable gases or oxygen.

Approved Respirators

Respiratory protective devices must be approved jointly by the Mine Safety and Health Administration of the Department of Labor, and the National Institute for Occupational Safety and Health of the Department of Health and Human Services, for the contaminant or situation to which the employee is exposed.

Summary

When planning a program to control occupational illness caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, vapors, or sprays, the primary objective should be to prevent such atmospheric contamination. Respirators must be used while effective engineering controls, if they are feasible, are being installed. If engineering controls are not feasible, employers must provide respirators and employees must wear them when it is necessary to protect the health of the employee. The equipment issued to the employee must be properly selected, used, and maintained for a particular work environment and contaminant.

FINAL ANALYSIS

To have an effective safety program, one manager must be responsible for its coordination. First line supervisors must be convinced of the hazard and must be held accountable for employees' use of personal protective equipment. A safety program for new employees is a necessary part of any orientation program. An on-going safety program should be used to motivate employees to continue to use protective gear.

Teaming the correct personal protective equipment with a good training program can give the worker a large measure of safety where other controls are inadequate or impossible.

Personal protective equipment can be effective only if the equipment is selected based on its intended use, employees are trained in its use, and the equipment is properly tested and maintained, and worn.

In the final analysis the best protection comes from an interested management and work force committed to sound work practices.

OSHA COMPLIANCE MANUAL**Sample Respiratory Protection Program****TABLE OF CONTENTS****1.0 Purpose****2.0 Scope and Application****3.0 Responsibilities****Program Administrator****Supervisors****Employees****4.0 Program Elements****Selection Procedures****Medical Evaluation****Fit Testing****Respirator Use****Air Quality****Cleaning, Maintenance, Change Schedules and Storage****Training****5.0 Program Evaluation****6.0 Documentation and Recordkeeping**

This Sample Respiratory Protection Program is for demonstration purposes only. XYZ Seating is not intended to represent an actual company. XYZ is a hypothetical company that has chosen to interpret certain provisions of 29 CFR 1910.134 in ways that could be different from the way another company might choose to implement it. This sample program is Appendix IV from OSHA's *Small Entity Compliance Guide for the Revised Respiratory Protection Standard*.

1.0 Purpose

XYZ Seating has determined that employees in the Prep, Coating, Assembly, and Maintenance departments are exposed to respiratory hazards during routine operations. These hazards include wood dust, particulates, and vapors, and in some cases represent Immediately Dangerous to Life or Health (IDLH) conditions. The purpose of this program is to ensure that all XYZ Seating employees are protected from exposure to these respiratory hazards.

Engineering controls, such as ventilation and substitution of less toxic materials, are the first line of defense at XYZ Seating; however, engineering controls have not always been feasible for some of our operations, or have not always completely controlled the identified hazards. In these situations, respirators and other protective equipment must be used. Respirators are also needed to protect employees' health during emergencies. The work processes requiring respirator use at XYZ Seating are outlined in Table 1 in the Scope and Application section of this program.

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In addition, some employees have expressed a desire to wear respirators during certain operations that do not require respiratory protection. As a general policy XYZ Seating will review each of these requests on a case-by-case basis. If the use of respiratory protection in a specific case will not jeopardize the health or safety of the worker(s), XYZ Seating will provide respirators for voluntary use. As outlined in the Scope and Application section of this program, voluntary respirator use is subject to certain requirements of this program.

2.0 Scope and Application

This program applies to all employees who are required to wear respirators during normal work operations, and during some non-routine or emergency operations such as a spill of a hazardous substance. This includes employees in the Prep, Coating (Spray Booth), Assembly, and Maintenance departments. All employees working in these areas and engaged in certain processes or tasks (as outlined in the table below) must be enrolled in the company's respiratory protection program.

In addition, any employee who voluntarily wears a respirator when a respirator is not required (i.e., in certain maintenance and coating operations) is subject to the medical evaluation, cleaning, maintenance, and storage elements of this program, and must be provided with certain information specified in this section of the program.¹

Employees participating in the respiratory protection program do so at no cost to them. The expense associated with training, medical evaluations and respiratory protection equipment will be borne by the company.

TABLE 1: VOLUNTARY AND REQUIRED RESPIRATOR USE AT XYZ SEATING	
Respirator	Department/Process
Filtering facepiece (dust mask)	Voluntary use for warehouse workers
Half-facepiece APR or PAPR with P100 filter	Prep and Assembly Voluntary use for maintenance workers when cleaning spray booth walls or changing spray booth filter
SAR, pressure demand, with auxiliary SCBA	Maintenance - dip coat tank cleaning
Continuous flow SAR with hood	Spray booth operations
	Prep (cleaning)*
Half-facepiece APR with organic vapor cartridge	Voluntary use for Dip Coat Tenders, Spray Booth Operators (gun cleaning), and Maintenance workers (loading coating agents into supply systems)
Escape SCBA	Dip Coat, Coatings Storage Area, Spray Booth Cleaning Area

* until ventilation is installed.

¹ Employees who voluntarily wear filtering facepieces (dust masks) are not subject to the medical evaluation, cleaning, storage, and maintenance provisions of this program.

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3.0 Responsibilities

Program Administrator

The Program Administrator is responsible for administering the respiratory protection program. Duties of the program administrator include:

- Identifying work areas, processes or tasks that require workers to wear respirators, and evaluating hazards.
- Selection of respiratory protection options.
- Monitoring respirator use to ensure that respirators are used in accordance with their certifications.
- Arranging for and/or conducting training.
- Ensuring proper storage and maintenance of respiratory protection equipment
- Conducting qualitative fit testing with Bitrex.
- Administering the medical surveillance program.
- Maintaining records required by the program.
- Evaluating the program.
- Updating written program, as needed.

The Program Administrator for Company XYZ Seating is _____.

Supervisors

Supervisors are responsible for ensuring that the respiratory protection program is implemented in their particular areas. In addition to being knowledgeable about the program requirements for their own protection, supervisors must also ensure that the program is understood and followed by the employees under their charge. Duties of the supervisor include:

- Ensuring that employees under their supervision (including new hires) have received appropriate training, fit testing, and annual medical evaluation.
- Ensuring the availability of appropriate respirators and accessories.
- Being aware of tasks requiring the use of respiratory protection.
- Enforcing the proper use of respiratory protection when necessary.
- Ensuring that respirators are properly cleaned, maintained, and stored according to the respiratory protection plan.
- Ensuring that respirators fit well and do not cause discomfort.
- Continually monitoring work areas and operations to identify respiratory hazards.
- Coordinating with the Program Administrator on how to address respiratory hazards or other concerns regarding the program.

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Employees

Each employee has the responsibility to wear his or her respirator when and where required and in the manner in which they were trained. Employees must also:

- Care for and maintain their respirators as instructed, and store them in a clean sanitary location.
- Inform their supervisor if the respirator no longer fits well, and request a new one that fits properly.
- Inform their supervisor or the Program Administrator of any respiratory hazards that they feel are not adequately addressed in the workplace and of any other concerns that they have regarding the program.

4.0 Program Elements

Selection Procedures

The Program Administrator will select respirators to be used on site, based on the hazards to which workers are exposed and in accordance with all OSHA standards. The Program Administrator will conduct a hazard evaluation for each operation, process, or work area where airborne contaminants may be present in routine operations or during an emergency. The hazard evaluation will include:

1. Identification and development of a list of hazardous substances used in the workplace, by department, or work process.
2. Review of work processes to determine where potential exposures to these hazardous substances may occur. This review shall be conducted by surveying the workplace, reviewing process records, and talking with employees and supervisors.
3. Exposure monitoring to quantify potential hazardous exposures. Monitoring will be contracted out. XYZ Seating currently has a contract with ABC Industrial Hygiene Services to provide monitoring when needed.

The results of the current hazard evaluation are the following: (Table 3 at the end of this program contains the sampling data that this section was based on.)

Prep-sanding: Ventilation controls on some sanders are in place, but employees continue to be exposed to respirable wood dust at 2.5 – 7.0 mg/m³ (8 hour time-weighted-average, or TWA). Half-facepiece APRs with P100 filters and goggles are required for employees sanding wood pieces. PAPRs will be available for employees who are unable to wear an APR.

Prep-cleaning: Average methylene chloride exposures measured at 70 ppm based on 8 hr. TWA exposure results for workers cleaning/stripping furniture pieces. Ventilation controls are planned, but will not be implemented until designs are completed and a contract has been let for installation of the controls. In the meantime, employees must wear supplied air hoods with continuous air flow, as required by the Methylene Chloride standard 1910.1052.

Coating-spray booth: XYZ Seating has decided to take a conservative approach and require all employees to wear supplied air respirators when working inside the spray booth. Based on exposure data in published reports on the same type of spray booth operations, the Program Administrator has determined that an SAR in the continuous flow mode will provide sufficient protection. Spray booth employees may opt to wear half-facepiece APRs with organic vapor cartridges when cleaning spray guns.

Coating-dip coat, and drying: Exposures are kept within PELs by ventilation, and employees generally enter the dip coat area for short time periods (up to one hour). Vapors could leak into the dip coat and drying areas if the ventilation system is not running at peak efficiency. Odors in this area are often unpleasant even at the levels maintained by the ventilation system. While XYZ Seating notes that respiratory protection is not required in this area, the company recognizes employee concern about breathing vapors and about having to work in an unpleasant environment. Accordingly, employees may voluntarily choose to wear a half-facepiece APR with organic vapor cartridges when working in this area.

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Assembly: Ventilation controls on sanders are in place, but employees continue to be exposed to respirable wood dust at 2.5 - 6.0 mg/m³ (8 hour TWA); half-facepiece APRs with P100 filters and goggles are required for employees sanding wood pieces in the assembly department. PAPRs will be available for employees who are unable to wear an APR. The substitution for aqueous-based glues will eliminate exposures to formaldehyde, methylene chloride, and epoxy resins.

Maintenance: Because of potential IDLH conditions, employees cleaning dip coat tanks must wear a pressure demand SAR during the performance of this task.

Employees may voluntarily wear half-facepiece APRs with P100 cartridges when cleaning spray booth walls or changing booth filters and half-facepiece APRs with organic vapor cartridges when loading coating agents into supply systems. Although exposure monitoring has shown that exposures are kept within PELs during these procedures, XYZ Seating will provide respirators to workers who are concerned about potential exposures.

Updating the Hazard Assessment

The Program Administrator must revise and update the hazard assessment as needed (i.e., any time work process changes may potentially affect exposure). If an employee feels that respiratory protection is needed during a particular activity, he/she is to contact his or her supervisor or the Program Administrator. The Program Administrator will evaluate the potential hazard, arranging for outside assistance as necessary. The Program Administrator will then communicate the results of that assessment back to the employees. If it is determined that respiratory protection is necessary, all other elements of this program will be in effect for those tasks and this program will be updated accordingly.

NIOSH Certification

All respirators must be certified by the National Institute for Occupational Safety and Health (NIOSH) and shall be used in accordance with the terms of that certification. Also, all filters, cartridges, and canisters must be labeled with the appropriate NIOSH approval label. The label must not be removed or defaced while it is in use.

Voluntary Respirator Use

XYZ Seating will provide respirators at no charge to employees for voluntary use for the following work processes:

- Employees may wear half-facepiece APRs with organic vapor cartridges while working in the dip coat area.
- Warehouse workers may wear filtering facepieces.
- Spray Booth Operators may wear half-facepiece APRs with organic vapor cartridges while cleaning spray guns.
- Maintenance personnel may wear half-facepiece APRs with P100 cartridges while cleaning spray booth walls, and organic vapor cartridges while loading spray guns.

The Program Administrator will provide all employees who voluntarily choose to wear either of the above respirators with a copy of Appendix D of the standard. (Appendix D details the requirements for voluntary use of respirators by employees.) Employees choosing to wear a half facepiece APR must comply with the procedures for Medical Evaluation, Respirator Use, and Cleaning, Maintenance and Storage.

The Program Administrator shall authorize voluntary use of respiratory protective equipment as requested by all other workers on a case-by-case basis, depending on specific workplace conditions and the results of the medical evaluations.

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Medical Evaluation

Employees who are either required to wear respirators, or who choose to wear an APR voluntarily, must pass a medical exam before being permitted to wear a respirator on the job. Employees are not permitted to wear respirators until a physician has determined that they are medically able to do so. Any employee refusing the medical evaluation will not be allowed to work in an area requiring respirator use.

A licensed physician at ABC medical clinic, where all company medical services are provided, will provide the medical evaluations. Medical evaluation procedures are as follows:

- The medical evaluation will be conducted using the questionnaire provided in Appendix C of the respiratory protection standard. The Program Administrator will provide a copy of this questionnaire to all employees requiring medical evaluations.
- To the extent feasible, the company will assist employees who are unable to read the questionnaire (by providing help in reading the questionnaire). When this is not possible, the employee will be sent directly to the physician for medical evaluation.
- All affected employees will be given a copy of the medical questionnaire to fill out, along with a stamped and addressed envelope for mailing the questionnaire to the company physician. Employees will be permitted to fill out the questionnaire on company time.
- Follow-up medical exams will be granted to employees as required by the standard, and/or as deemed necessary by the ABC medical clinic physician.
- All employees will be granted the opportunity to speak with the physician about their medical evaluation, if they so request.
- The Program Administrator has provided the ABC medical clinic physician with a copy of this program, a copy of the Respiratory Protection standard, the list of hazardous substances by work area, and for each employee requiring evaluation: his or her work area or job title, proposed respirator type and weight, length of time required to wear respirator, expected physical work load (light, moderate, or heavy), potential temperature and humidity extremes, and any additional protective clothing required.
- Any employee required for medical reasons to wear a positive pressure air purifying respirator will be provided with a powered air purifying respirator.
- After an employee has received clearance and begun to wear his or her respirator, additional medical evaluations will be provided under the following circumstances:
 - Employee reports signs and/or symptoms related to their ability to use a respirator, such as shortness of breath, dizziness, chest pains, or wheezing.
 - The ABC medical clinic physician or supervisor informs the Program Administrator that the employee needs to be reevaluated;
 - Information from this program, including observations made during fit testing and program evaluation, indicates a need for reevaluation;
 - A change occurs in workplace conditions that may result in an increased physiological burden on the employee.

A list of XYZ Seating employees currently included in medical surveillance is provided in Table 2 of this program.

All examinations and questionnaires are to remain confidential between the employee and the physician.

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Fit Testing

Fit testing is required for employees wearing half-facepiece APRs for exposure to wood dust in Prep and Assembly, and maintenance workers who wear a tight-fitting SAR for dip tank cleaning. Employees voluntarily wearing half-facepiece APRs may also be fit tested upon request.

Employees who are required to wear half-facepiece APRs will be fit tested:

- Prior to being allowed to wear any respirator with a tight fitting facepiece.
- Annually.
- When there are changes in the employee's physical condition that could affect respiratory fit (e.g., obvious change in body weight, facial scarring, etc.).

Employees will be fit tested with the make, model, and size of respirator that they will actually wear. Employees will be provided with several models and sizes of respirators so that they may find an optimal fit. Fit testing of PAPRs is to be conducted in the negative pressure mode.

The Program Administrator will conduct fit tests following the OSHA approved Bitrex Solution Aerosol QLFT Protocol in Appendix B (B4) of the Respiratory Protection standard.

The Program Administrator has determined that QNFT is not required for the respirators used under current conditions at XYZ Seating. If conditions affecting respirator use change, the Program Administrator will evaluate on a case-by-case basis whether QNFT is required.

Respirator Use

Respiratory protection is required for the following personnel:

TABLE 2: XYZ Seating Personnel in Respiratory Protection Program			
Name	Department	Job Description/ Work Procedure	Respirator
Joe Apple	Prep	Operator	Half mask APR P100 filter when sanding/ SAR continuous flow hood for cleaning
Ron Carey	Maintenance	Dip tank cleaning	SAR, pressure demand with auxiliary SCBA
Lisa Jones	Coating	Spray Booth Operator	SAR, continuous flow hood

General Use Procedures:

- Employees will use their respirators under conditions specified by this program, and in accordance with the training they receive on the use of each particular model. In addition, the respirator shall not be used in a manner for which it is not certified by NIOSH or by its manufacturer.
- All employees shall conduct user seal checks each time that they wear their respirator. Employees shall use either the positive or negative pressure check (depending on which test works best for them) specified in Appendix B-1 of the Respiratory Protection Standard.
- All employees shall be permitted to leave the work area to go to the locker room to maintain their respirator for the following reasons: to clean their respirator if the respirator is impeding their ability to work, change filters or cartridges, replace parts, or to inspect respirator if it stops functioning as intended. Employees should notify their supervisor before leaving the area.

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- Employees are not permitted to wear tight-fitting respirators if they have any condition, such as facial scars, facial hair, or missing dentures, that prevents them from achieving a good seal. Employees are not permitted to wear headphones, jewelry, or other articles that may interfere with the facepiece-to-face seal.

Emergency Procedures:

The following work areas have been identified as having foreseeable emergencies:

Spray Booth Cleaning Area - spill of hazardous waste

Dip Coat Area - malfunction of ventilation system, leak in supply system

Coatings Storage Area - spill or leak of hazardous substances

When the alarm sounds, employees in the affected department must immediately don their emergency escape respirator, shut down their process equipment, and exit the work area. All other employees must immediately evacuate the building. XYZ Seating's Emergency Action Plan describes these procedures (including proper evacuation routes and rally points) in greater detail.

Emergency escape respirators are located:

Locker #1 in the Spray Booth Area

Storage cabinet #3 in Dip Coat/Drying Area

Locker #4 in the Coatings Storage Area

Respiratory protection in these instances is for escape purposes only. XYZ Seating employees are not trained as emergency responders, and are not authorized to act in such a manner.

Respirator Malfunction

1. APR Respirator Malfunction:

For any malfunction of an APR (e.g., such as breakthrough, facepiece leakage, or improperly working valve), the respirator wearer should inform his or her supervisor that the respirator no longer functions as intended, and go to the designated safe area to maintain the respirator. The supervisor must ensure that the employee receives the needed parts to repair the respirator, or is provided with a new respirator.

All workers wearing atmosphere-supplying respirators will work with a buddy. Buddies shall assist workers who experience an SAR malfunction as follows:

If a worker in the spray booth experiences a malfunction of an SAR, he or she should signal to the buddy that he or she has had a respirator malfunction. The buddy shall don an emergency escape respirator and aid the worker in immediately exiting the spray booth.

Workers cleaning wood pieces or assembled furniture in the Prep department will work with a buddy. If one of the workers experiences a respirator malfunction, he/she shall signal this to their buddy. The buddy must immediately stop what he or she is doing to escort the employee to the Prep staging area where the employee can safely remove the SAR.

IDLH Procedures

The Program Administrator has identified the following area as presenting the potential for IDLH conditions:

Dip Coat Tank Cleaning:

Maintenance workers will be periodically required to enter the dip tank to perform scheduled or unscheduled maintenance. In such cases, workers will follow the permit required confined space entry procedures specified in the XYZ Seating Confined Space Program. As specified in these procedures, the Program Administrator has determined that workers entering this area shall wear a pressure demand SAR. In addition, an appropriately trained and equipped standby person shall remain outside the dip tank and maintain constant voice and visual communication with the worker. In the event of an emergency requiring the standby person

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to enter the IDLH environment, the standby person shall immediately notify the Program Administrator and will proceed with rescue operations in accordance with rescue procedures outlined in the XYZ Seating Confined Space Program.

Air Quality

For supplied-air respirators, only Grade D breathing air shall be used in the cylinders. The Program Administrator will coordinate deliveries of compressed air with the company's vendor, Compressed Air Inc., and require Compressed Air Inc. to certify that the air in the cylinders meets the specifications of Grade D breathing air.

The Program Administrator will maintain a minimum air supply of one fully charged replacement cylinder for each SAR unit. In addition, cylinders may be recharged as necessary from the breathing air cascade system located near the respirator storage area. The air for this system is provided by XYZ Seating's supplier, and deliveries of new air are coordinated by the Program Administrator.

Cleaning, Maintenance, Change Schedules and Storage

Cleaning

Respirators are to be regularly cleaned and disinfected at the designated respirator cleaning station located in the employee locker room.

Respirators issued for the exclusive use of an employee shall be cleaned as often as necessary, but at least once a day for workers in the Prep and Assembly departments.

Atmosphere supplying and emergency use respirators are to be cleaned and disinfected after each use.

The following procedure is to be used when cleaning and disinfecting respirators:

- Disassemble respirator, removing any filters, canisters, or cartridges.
- Wash the facepiece and associated parts in a mild detergent with warm water. Do not use organic solvents.
- Rinse completely in clean warm water.
- Wipe the respirator with disinfectant wipes (70 percent Isopropyl Alcohol) to kill germs.
- Air dry in a clean area.
- Reassemble the respirator and replace any defective parts.
- Place in a clean, dry plastic bag or other air tight container.

Note: The Program Administrator will ensure an adequate supply of appropriate cleaning and disinfection material at the cleaning station. If supplies are low, employees should contact their supervisor, who will inform the Program Administrator.

Maintenance

Respirators are to be properly maintained at all times in order to ensure that they function properly and adequately protect the employee. Maintenance involves a thorough visual inspection for cleanliness and defects. Worn or deteriorated parts will be replaced prior to use. No components will be replaced or repairs made beyond those recommended by the manufacturer. Repairs to regulators or alarms of atmosphere-supplying respirators will be conducted by the manufacturer.

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The following checklist will be used when inspecting respirators:

- Facepiece:
 - cracks, tears, or holes
 - facemask distortion
 - cracked or loose lenses/faceshield
- Headstraps:
 - breaks or tears
 - broken buckles
- Valves:
 - residue or dirt
 - cracks or tears in valve material
- Filters/Cartridges:
 - approval designation
 - gaskets
 - cracks or dents in housing
 - proper cartridge for hazard
- Air Supply Systems:
 - breathing air quality/grade
 - condition of supply hoses
 - hose connections
 - settings on regulators and valves

Employees are permitted to leave their work area to perform limited maintenance on their respirator in a designated area that is free of respiratory hazards. Situations when this is permitted include to wash their face and respirator facepiece to prevent any eye or skin irritation, to replace the filter, cartridge or canister, and if they detect vapor or gas breakthrough or leakage in the facepiece or if they detect any other damage to the respirator or its components.

Change Schedules

Employees wearing APRs or PAPRs with P100 filters for protection against wood dust and other particulates shall change the cartridges on their respirators when they first begin to experience difficulty breathing (i.e., resistance) while wearing their masks.

Based on discussions with our respirator distributor about XYZ Seating's workplace exposure conditions, employees voluntarily wearing APRs with organic vapor cartridges shall change the cartridges on their respirators at the end of each work week to ensure the continued effectiveness of the respirators.

Storage

Respirators must be stored in a clean, dry area, and in accordance with the manufacturer's recommendations. Each employee will clean and inspect their own air-purifying respirator in accordance with the provisions of this program and will store their respirator in a plastic bag in their own locker. Each employee will have his/her name on the bag and that bag will only be used to store that employee's respirator.

Atmosphere supplying respirators will be stored in the storage cabinet outside of the Program Administrator's office.

The Program Administrator will store XYZ's supply of respirators and respirator components in their original manufacturer's packaging in the equipment storage room.

Defective Respirators

Respirators that are defective or have defective parts shall be taken out of service immediately. If, during an inspection, an employee discovers a defect in a respirator, he/she is to bring the defect to the attention of

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his or her supervisor. Supervisors will give all defective respirators to the Program Administrator. The Program Administrator will decide whether to:

- Temporarily take the respirator out of service until it can be repaired.
- Perform a simple fix on the spot such as replacing a headstrap.
- Dispose of the respirator due to an irreparable problem or defect.

When a respirator is taken out of service for an extended period of time, the respirator will be tagged out of service, and the employee will be given a replacement of similar make, model, and size. All tagged out respirators will be kept in the storage cabinet inside the Program Administrator's office.

Training

The Program Administrator will provide training to respirator users and their supervisors on the contents of the XYZ Seating Respiratory Protection Program and their responsibilities under it, and on the OSHA Respiratory Protection standard. Workers will be trained prior to using a respirator in the workplace. Supervisors will also be trained prior to using a respirator in the workplace or prior to supervising employees that must wear respirators.

The training course will cover the following topics:

- the XYZ Seating Respiratory Protection Program
- the OSHA Respiratory Protection standard
- respiratory hazards encountered at XYZ Seating and their health effects
- proper selection and use of respirators
- limitations of respirators
- respirator donning and user seal (fit) checks
- fit testing
- emergency use procedures
- maintenance and storage
- medical signs and symptoms limiting the effective use of respirators

Employees will be retrained annually or as needed (e.g., if they change departments and need to use a different respirator). Employees must demonstrate their understanding of the topics covered in the training through hands-on exercises and a written test. Respirator training will be documented by the Program Administrator and the documentation will include the type, model, and size of respirator for which each employee has been trained and fit tested.

5.0 Program Evaluation

The Program Administrator will conduct periodic evaluations of the workplace to ensure that the provisions of this program are being implemented. The evaluations will include regular consultations with employees who use respirators and their supervisors, site inspections, air monitoring and a review of records.

Problems identified will be noted in an inspection log and addressed by the Program Administrator. These findings will be reported to XYZ Seating management, and the report will list plans to correct deficiencies in the respirator program and target dates for the implementation of those corrections.

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6.0 Documentation and Recordkeeping

A written copy of this program and the OSHA standard is kept in the Program Administrator's office and is available to all employees who wish to review it.

Also maintained in the Program Administrator's office are copies of training and fit test records. These records will be updated as new employees are trained, as existing employees receive refresher training, and as new fit tests are conducted.

The Program Administrator will also maintain copies of the medical records for all employees covered under the respirator program. The completed medical questionnaire and the physician's documented findings are confidential and will remain at ABC Medical Clinic. The company will only retain the physician's written recommendation regarding each employee's ability to wear a respirator.

TABLE 3: XYZ SEATING HAZARD ASSESSMENT - JUNE 1998

Department	Contaminants	Exposure Level (8 hrs TWA)*	PEL	Controls
Prep: Sanding	wood dust	2.5 - 7.0mg/m ³	5 mg/m ³ (TLV= 1 mg/m ³)	Local exhaust ventilation (LEV) for sanders. Half-facepiece APR with P100 filter.
Prep: Cleaning	methylene chloride	70 ppm	25 ppm 125 ppm = STEL	LEV to be installed for cleaning stations. Continuous flow SAR hood until then needed for respiratory protection. Will reevaluate after LEV installation.
	methanol acetone	150 ppm 400 ppm	200 ppm 1,000 ppm	
Coating: Spray booth painting	toluene	(300 ppm)**	200 ppm 500 ppm = 10 min peak	Continuous flow SAR hood.
	xylene	(40 ppm)**	100 ppm 150 ppm = STEL	
	MEK (methyl ethyl ketone)	(25 ppm)**	200 ppm	
	methanol	(20 ppm)**	200 ppm	
Coating: Spray booth gun cleaning	toluene	80 ppm (30 min)	200 ppm 500 ppm = 10 min peak	Half-facepiece APR with organic vapor cartridge.
	methanol	300 (30 min)	200 ppm	
Coating: Dip Coat	toluene	25 ppm	200 ppm 500 ppm = 10 min peak	Automated line is vented. Workers may voluntarily wear half-facepiece APR with organic vapor cartridge.
	xylene	50 ppm	100 ppm 150 ppm = STEL	
	MEK	60 ppm	200 ppm	
	MIBK	10 ppm	100 ppm	
	methanol	50 ppm	200 ppm	

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TABLE 3: XYZ SEATING HAZARD ASSESSMENT - JUNE 1998, Continued

Department	Contaminants	Exposure Level (8 hrs TWA)*	PEL	Controls
Drying (oven)	None (monitoring revealed no significant exposures)	NA	NA	NA
Assembly: Sanding, gluing and nailing	wood dust	2.5 - 6.0 mg/m ³	5 mg/m ³ (TLV= 1 mg/m ³)	Aqueous-based glues will be used to eliminate exposures to methylene chloride, formaldehyde and epichlorohydrin
	formaldehyde	1.0 ppm	0.75 ppm 2 ppm = STEL	
	epichlorohydrin	4 ppm	5 ppm	
	methylene chloride	60 ppm	25 ppm 125 ppm = STEL	
Maintenance: Dip tank cleaning	toluene, xylene, MEK, MIBK, methanol	IDLH conditions		SAR, pressure demand with auxiliary SCBA must be worn
Maintenance: Spray booth cleaning/filter change	particulates	1.8 mg/m ³	5 mg/m ³	Voluntary use, half-facepiece APR with P100 filter
Maintenance: Loading coatings into supply systems	toluene	40 ppm (1 hr)	200 ppm 500 ppm = 10 min peak	Voluntary use, half-facepiece APR with organic vapor cartridges
	xylene	80 ppm (1 hr)	100 ppm 150 ppm = STEL	
	MEK	100 ppm (1 hr)	200 ppm	
	MIBK	15 ppm (1 hr)	100 ppm	
	methanol	125 ppm (1 hr)	200 ppm	
Warehouse	None	NA	NA	NA

* Summarized from Industrial Hygiene report provided by ABC Industrial Hygiene Services.

** These values were obtained from a survey on average exposures in downdraft spray booths utilized in the furniture coating industry as published in the American Journal of Industrial Hygiene _____.

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RESPIRATORY PROGRAM CHECKLISTS

RESPIRATORY PROTECTION PROGRAMS

Check to ensure that your facility has:

- ☐ A written respiratory protection program that is specific to your workplace and covers the following:
 - ☐ Procedures for selecting respirators.
 - ☐ Medical evaluations of employees required to wear respirators.
 - ☐ Fit testing procedures.
 - ☐ Routine use procedures and emergency respirator use procedures.
 - ☐ Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and maintaining respirators.
 - ☐ Procedures for ensuring adequate air quality for supplied air respirators.
 - ☐ Training in respiratory hazards.
 - ☐ Training in proper use and maintenance of respirators.
 - ☐ Program evaluation procedures.
 - ☐ Procedures for ensuring that workers who voluntarily wear respirators (excluding filtering facepieces) comply with the medical evaluation, and cleaning, storing and maintenance requirements of the standard.
- ☐ A designated program administrator who is qualified to administer the program.
- ☐ Updated the written program as necessary to account for changes in the workplace affecting respirator use.
- ☐ Provided equipment, training, and medical evaluations at no cost to employees.

RESPIRATOR SELECTION

Check that at your facility:

- ☐ Respiratory hazards in your workplace have been identified and evaluated.
- ☐ Employee exposures that have not been, or cannot be, evaluated are considered IDLH.
- ☐ Respirators are NIOSH certified, and used under the conditions of certification.
- ☐ Respirators are selected based on the workplace hazards evaluated and workplace and user factors affecting respirator performance and reliability.
- ☐ A sufficient number of respirator sizes and models are provided to be acceptable and correctly fit the users.
- ☐ For IDLH atmospheres:
 - ☐ Full facepiece pressure demand SARs with auxiliary SCBA unit or full facepiece pressure demand SCBAs, with a minimum service life of 30 minutes, are provided.
 - ☐ Respirators used for escape only are NIOSH certified for the atmosphere in which they will be used.
 - ☐ Oxygen deficient atmospheres are considered IDLH.

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- ☐ For Non-IDLH atmospheres:
 - ☐ Respirators selected are appropriate for the chemical state and physical form of the contaminant.
 - ☐ Air-purifying respirators used for protection against gases and vapors are equipped with ESLs or a change schedule has been implemented.
 - ☐ Air-purifying respirators used for protection against particulates are equipped with NIOSH-certified HEPA filters or other filters certified by NIOSH for particulates under 42 CFR part 84.

MEDICAL EVALUATION

Check that at your facility:

- ☐ All employees have been evaluated to determine their ability to wear a respirator prior to being fit tested for or wearing a respirator for the first time in your workplace.
- ☐ A physician or other licensed health care professional (PLHCP) has been identified to perform the medical evaluations.
- ☐ The medical evaluations obtain the information requested in Sections 1 and 2, Part A of Appendix C of the standard, 29 CFR 1910.134.
- ☐ Employees are provided follow-up medical exams if they answer positively to any of questions 1 through 8 in Section 2, Part A of Appendix C, or if their initial medical evaluation reveals that a follow-up exam is needed.
- ☐ Medical evaluations are administered confidentially during normal work hours, and in a manner that is understandable to employees.
- ☐ Employees are provided the opportunity to discuss the medical evaluation results with the PLHCP.
- ☐ The following supplemental information is provided to the PLHCP before he or she makes a decision about respirator use:
 - ☐ Type and weight of the respirator.
 - ☐ Duration and frequency of respirator use.
 - ☐ Expected physical work effort.
 - ☐ Additional protective clothing to be worn.
 - ☐ Potential temperature and humidity extremes.
 - ☐ Written copies of the respiratory protection program and the Respiratory Protection standard.
- ☐ Written recommendations are obtained from the PLHCP regarding each employee's ability to wear a respirator, and that the PLHCP has given the employee a copy of these recommendations.
- ☐ Employees who are medically unable to wear a negative pressure respirator are provided with a powered air-purifying respirator (PAPR) if they are found by the PLHCP to be medically able to use a PAPR.
- ☐ Employees are given additional medical evaluations when:
 - ☐ The employee reports symptoms related to his or her ability to use a respirator.
 - ☐ The PLHCP, respiratory protection program administrator, or supervisor determines that a medical reevaluation is necessary.
 - ☐ Information from the respiratory protection program suggests a need for reevaluation.
 - ☐ Workplace conditions have changed in a way that could potentially place an increased burden on the employee's health.

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FIT TESTING

Check that at your facility:

- ☐ Employees who are using tight fitting respirator facepieces have passed an appropriate fit test prior to being required to use a respirator.
- ☐ Fit testing is conducted with the same make, model, and size that the employee will be expected to use at the worksite.
- ☐ Fit tests are conducted annually and when different respirator facepieces are to be used.
- ☐ Provisions are made to conduct additional fit tests in the event of physical changes in the employee that may affect respirator fit.
- ☐ Employees are given the opportunity to select a different respirator facepiece, and be retested, if their respirator fit is unacceptable to them.
- ☐ Fit tests are administered using OSHA-accepted QNFT or QLFT protocols.
- ☐ QLFT is only used to fit test either PAPRs, SCBAs, or negative pressure APRs that must achieve a fit factor of 100 or less.
- ☐ QNFT is used in all situations where a negative pressure respirator is intended to protect workers from contaminant concentrations greater than 10 times the PEL.
- ☐ When QNFT is used to fit negative pressure respirators, a minimum fit factor of 100 is achieved for tight-fitting half-facepieces and 500 for full-facepieces.
- ☐ For tight-fitting atmosphere-supplying respirators and powered air-purifying respirators:
 - ☐ Fit tests are conducted in the negative pressure mode.
 - ☐ QLFT is achieved by temporarily converting the facepiece into a negative pressure respirator with appropriate filters, or by using an identical negative pressure APR.
 - ☐ QNFT is achieved by modifying the facepiece to allow for sampling inside the mask midway between the nose and mouth. The facepiece is restored to its NIOSH approved configuration before being used in the workplace.

PROPER USE OF RESPIRATORS

Check your facility to be certain that:

- ☐ Workers using tight-fitting respirators have no conditions, such as facial hair, that would interfere with a face-to-facepiece seal or valve function.
- ☐ Workers wear corrective glasses, goggles, or other protective equipment in a manner that does not interfere with the face-to-facepiece seal or valve function.
- ☐ Workers perform user seal checks prior to each use of a tight-fitting respirator.
- ☐ There are procedures for conducting ongoing surveillance of the work area for conditions that affect respirator effectiveness, and that, when such conditions exist, you take steps to address those situations.
- ☐ Employees are permitted to leave their work area to conduct respirator maintenance, such as washing the facepiece, or to replace respirator parts.
- ☐ Employees do not return to their work area until their respirator has been repaired or replaced in the event of breakthrough, a leak in the facepiece, or a change in breathing resistance.

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- ☐ There are procedures for respirator use in IDLH atmospheres and during interior structural firefighting to ensure that: the appropriate number of standby personnel are deployed; standby personnel and employees in the IDLH environment maintain communication; standby personnel are properly trained, equipped, and prepared; you will be notified when standby personnel enter an IDLH atmosphere; and you will respond to this notification.
- ☐ Standby personnel are equipped with a pressure demand or other positive pressure. SCBA, or a positive pressure supplied air respirator with an escape SCBA, and appropriate retrieval equipment or other means for rescue.
- ☐ Procedures for interior structural firefighting require that: at least two employees enter the IDLH atmosphere and remain in contact with one another at all times; at least two standby personnel are used; and all firefighting employees use SCBAs.

RESPIRATOR MAINTENANCE AND CARE

Check to make sure that your facility has met the following requirements:

Cleaning and Disinfecting

- ☐ Respirators are provided that are clean, sanitary, and in good working order.
- ☐ Respirators are cleaned and disinfected using the procedures specified in Appendix B-2 of the standard.
- ☐ Respirators are cleaned and disinfected:
 - ☐ As often as necessary when issued for the exclusive use of one employee.
 - ☐ Before being worn by different individuals.
 - ☐ After each use for emergency use respirators.
 - ☐ After each use for respirators used for fit testing and training.

Storage

- ☐ Respirators are stored to protect them from damage from the elements, and from becoming deformed.
- ☐ Emergency respirators are stored:
 - ☐ To be accessible to the work area.
 - ☐ In compartments marked as such.
 - ☐ In accordance with manufacturer's recommendations.

Inspections

- ☐ Routine-use respirators are inspected before each use and during cleaning.
- ☐ SCBAs and emergency respirators are inspected monthly and checked for proper function before and after each use.
- ☐ Emergency escape-only respirators are inspected before being carried into the workplace for use.
- ☐ Inspections include:
 - ☐ Check of respirator function.
 - ☐ Tightness of connections.
 - ☐ Condition of the facepiece, head straps, valves, and cartridges.
 - ☐ Condition of elastomeric parts.

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- ☐ For SCBAs, inspection includes checking that cylinders are fully charged, and that regulators and warning devices function properly.
- ☐ Emergency use respirators are certified by documenting the inspection, and by tagging the information either to the respirator or its compartment, or storing it with inspection reports.

Repairs

- ☐ Respirators that have failed inspection are taken out of service.
- ☐ Repairs are made only by trained personnel.
- ☐ Only NIOSH-approved parts are used.
- ☐ Reducing and admission valves, regulators and alarms are adjusted or repaired only by the manufacturer or a technician trained by the manufacturer.

BREATHING AIR QUALITY AND USE

Check that at your facility:

General

- ☐ Compressed breathing air meets the requirements for Grade D breathing air.
- ☐ Compressed oxygen is not used in respirators that have previously used compressed air.
- ☐ Oxygen concentrations greater than 23.5 percent are used only in equipment designed for oxygen service or distribution.
- ☐ Breathing air couplings are incompatible with outlets for other gas systems.
- ☐ Breathing gas containers are marked with appropriate NIOSH certification.

Breathing Air Cylinders

- ☐ Cylinders are tested and maintained according to DOT 49 CFR Part 173 and 178.
- ☐ A certificate of analysis for breathing air has been obtained from the supplier.
- ☐ Moisture content in the cylinder does not exceed a dew point of -50° F at 1 atmosphere pressure.

Compressors

- ☐ Are constructed and situated to prevent contaminated air from getting into the system.
- ☐ Are set up to minimize the moisture content.
- ☐ Are equipped with in-line air-purifying sorbent beds and/or filters that are maintained or replaced following manufacturer's instructions.
- ☐ Are tagged with information on the most recent change date of the filter and an authorizing signature.
- ☐ Carbon monoxide does not exceed 10 ppm in the breathing air from compressors that are not oil-lubricated.
- ☐ High-temperature and carbon monoxide alarms are used on oil-lubricated compressors, or that the air is monitored often enough to ensure that carbon monoxide does not exceed 10 ppm if only a high-temperature alarm is used.